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REVIEW OF THE HAWKFISHES (FAMILY CIRRHITIDAE)

By JOHN E. RANDALL [1]

The Cirrhitidae is a family of 10 genera and 34 species of carnivorous fishes, usually small and often colorful, which inhabit warm seas. One of the genera and six of the species are herein described as new. The family is characterized as follows: pectoral fins with 14 rays, the lower 5 to 7 rays unbranched and usually enlarged with membranes deeply incised; 1 dorsal fin, notched between spinous and soft portions, with 10 spines and 11 to 17 rays (the spinous portion, however, of greater basal length than the soft); anal fin with 3 spines and 5 to 7 (usually 6) rays; 15 principal caudal rays; 6 branchiostegal rays; pelvic rays I,5; 1 or more cirri projecting posteriorly from interspinous membranes near tips of dorsal spines; a fringe of cirri on hind edge of anterior nostril; gill membranes broadly joined with a free fold across isthmus; no air bladder; 26 vertebrae.

[1] Contribution No. 409 from The Marine Laboratory, University of Miami. Author now Professor of Biology, University of Puerto Rico, Mayagüez, Puerto Rico.

With the exception of the presence or absence of palatine teeth, the dentition of cirrhitids is relatively unchanging from species to species. Teeth are present on the vomer. There is a row of canine teeth in both jaws which are usually longer anteriorly in the upper jaw; the longest canines in the lower jaw are usually a group of 2 to 4 on each side about half way back in the series of teeth. A band of small villiform teeth, broader anteriorly, occurs inside the canines of the jaws (restricted to front of lower jaw). Additional characteristics and discussion of the closely related families Chironemidae, Aplodactylidae, Cheilodactylidae, and Latrididae are given by Regan (1911).

Hawkfishes occur mostly in shallow water, often only a few feet deep. Species of the genera *Oxycirrhites* and *Cyprinocirrhites*, however, appear to live primarily at depths of about 15 to 60 fathoms. The shallow-water cirrhitids, at least, dwell upon the bottom as do the related scorpaenids. The thickened condition of the lower pectoral rays may be an adaptation for the demersal habit, inasmuch as the lower part of these fins makes contact with the coral or rock substratum. In general, the cirrhitids are more active than the scorpaenids and frequently move short distances from one part of a reef to another. Some smaller species commonly seek refuge in interstices of living coral. Chacko (1949), Randall (1955), and Hiatt and Strasburg (1960) reported on the food habits of some of the cirrhitids.

The Cirrhitidae is dominantly an Indo-Pacific family. Only 2 species are known from the Atlantic, 1 from west Africa and the other from the West Indian region. Within the vast Indo-Pacific area the number of cirrhitid fishes recorded from subregions or island groups in the last 2 decades is as follows: western Indian Ocean, 9 (Smith, 1951); East Indies, 10 (de Beaufort, 1940); Philippine Islands, 5 (Herre, 1953); Phoenix and Samoa Islands, 7 (Schultz, 1943); Gilbert Islands, 5 (Randall, 1955); Marshall Islands, 6 (Schultz *in* Schultz and collaborators, 1960); Hawaiian Islands, 5 (Gosline and Brock, 1960).

To obtain the above numbers of species, the following allocation of certain nominal and valid species must be considered: *Cirrhitus mossambicus* Smith has been referred to the synonymy as a juvenile of *C. nigropunctatus* Schultz (=*Cirrhitus punctatus* Cuvier *in* Cuvier and Valenciennes) by Schultz *in* Schultz and collaborators, 1960. *Cirrhitichthys aprinus* (Cuvier), a name applied by most recent authors to *C. oxycephalus* (Bleeker), is distinct from *oxycephalus*. *Paracirrhites polystictus* (Günther) appears to be a color phase of *P. hemistictus* (Günther) (Marshall, 1950). *Amblycirrhitus oxyrhynchos* (Bleeker)

and *Paracirrhites amblycephalus* (Bleeker), placed in synonymy by de Beaufort (1940) and other authors, are valid species.

Specimens of 12 species of hawkfishes were collected in French Oceania (Society Islands, Marquesas Islands and Tuamotu Archipelago) and nearby Caroline Atoll (10° S., 150° W.) by the author in 1956 and 1957. These have been deposited in the U.S. National Museum under numbers 190564 to 190586 and the George Vanderbilt Foundation, Stanford University (SU). Analysis of these collections has led to the present review of the family.

That southeastern Oceania should have more species of cirrhitid fishes than the East Indies or Philippines is contrary to the usual faunal picture wherein the number of species in a group is greatest in the Indo-Malayan region and diminishes eastward. This apparent contradiction with respect to the distribution of cirrhitids probably reflects a greater collecting effort in Oceania.

All available specimens of the Cirrhitidae deposited at the following institutions have been examined: U.S. National Museum (USNM), Academy of Natural Sciences of Philadelphia (ANSP), American Museum of Natural History (AMNH), Museum of Comparative Zoology at Harvard University (MCZ), Bingham Oceanographic Laboratory at Yale University (BOC), Marine Laboratory of the University of Miami (UMML), Muséum National d'Histoire Naturelle in Paris (MNHN), and Museu e Laboratório Zoológico in Lisbon. Assistance of the curators of fishes of these institutions and especially of the staff of the Division of Fishes of the U.S. National Museum is gratefully acknowledged; that institution provided working quarters for the author during part of the study, and its material of the Cirrhitidae formed much of the basis for this revision.

Thanks are due W. J. Baldwin of the University of California at Los Angeles, M. L. Bauchot of the Muséum National d'Histoire Naturelle in Paris, M. Boeseman of the Rijksmuseum van Natuurlijke Historie at Leiden, E. H. Bryan, Jr. of the Bernice P. Bishop Museum in Honolulu, K. Deckert of the Zoologisches Museum in Berlin W. A. Gosline of the University of Hawaii (UH), T. Kamohara of Kochi University, W. Klausewitz of the Senckenberg Museum at Frankfurt, T. Monod of the Université de Dakar, J. Nielsen of the Universitets Zoologiske Museum at Copenhagen, R. Rosenblatt of the Scripps Institution of Oceanography (SI), D. W. Strasburg of the U.S. Fish and Wildlife Service in Honolulu, M. Torchio of the Museo Civico di Storia Naturale in Milan, A. C. Wheeler and N. B. Marshall of the British Museum (Natural History) (BM), G. P. Whitley of the Australian Museum, and L. P. Woods of the Chicago Natural History Museum for information on specimens and loans. Drawings

of new species were made by Fanny L. Phillips; the photographs were taken by the author.

Standard length was taken from the front of the upper lip with mouth closed to the base of the caudal fin (that is, end of hypural plate). Head length was measured from the front of the upper lip to the most posterior part of the opercular membrane, snout length from the front of the upper lip to the edge of the eye, and length of caudal peduncle from a vertical at rear base of dorsal fin to base of caudal fin. All fin rays that have a separate basal element, regardless of spacing, were counted. Scale rows above the lateral line were counted in the middle of the body. Only the rows of large scales were counted; once a row of scales showed a marked diminution in size to the row beneath it, it was not counted. If the scale rows are counted from the lateral line to the origin of the dorsal fin, there is often one scale more than may be counted in the middle of the body. Gill-raker counts include rudiments. Capped roman numerals designate spines and lowercase roman numerals unbranched soft rays (pectoral counts only). The number of serrations on the free margin of the preopercle increase with age (fig. 1); therefore, this count is often without value unless lengths of specimens are given. The number of specimens on which meristic data are based is enclosed in parentheses after the counts in species discussions, along with locality or localities of these specimens. All counts are included in species diagnoses, although not all are diagnostic. Characters given in the diagnoses and key to genera are usually not repeated in species accounts.

Key to the Genera of the Cirrhitidae [2]

1a. Scales ctenoid; 3 spines on opercle; 2 rows of scales above lateral line (subfamily ISOBUNINAE) . . . . . **Isobuna** (p. 393)

1b. Scales cycloid; 2 indistinct flattened spines on edge of opercle; 3 to 5 rows of scales above lateral line (subfamily CIRRHITINAE).

2a. Snout not elongate, its length about 3 to 5 in head length; body not slender, the depth 2 to 3.4 in standard length; canine teeth in jaws markedly longer than inner villiform teeth, those at front of upper jaw and side of lower jaw enlarged.

3a. Caudal fin rounded, truncate, or slightly emarginate; dorsal soft rays 11 to 15.

4a. No large scales on cheek (small scales in more than 12 irregular rows).

5a. Body not deep and not compressed, the depth 2.6 to 3.4 in standard length and the width 1.5 to 1.9 in depth; dorsal soft rays 11 (rarely 12); palatine teeth present; upper margin of preopercle finely serrate or smooth; lower 7 pectoral rays unbranched. **Cirrhitus** (p. 395)

[2] The Japanese genus *Serranocirrhitus* Watanabe (1949), no specimen of which has been examined, is not considered in the present paper. Although this genus may ultimately be placed in the Cirrhitidae as intended by Watanabe, it differs notably from other cirrhitids in having all the pectoral rays unbranched and not thickened, no teeth on the vomer, and the configuration of a pomacentrid. Like *Isobuna*, it has ctenoid scales.

5b. Body deep and compressed, the depth 2 to 2.4 in standard length and the width 2.9 to 3.1 in depth; dorsal soft rays 13; palatine teeth absent; upper margin or preopercle coarsely serrate; lower 6 pectoral rays unbranched . . . . . **Neocirrhites** (p. 403)

4b. Rows of large scales on cheek 4 to 6 (small scales also usually present).

6a. Rows of large scales between lateral line and spinous portion of dorsal fin 5; a single cirrus from membrane near tip of each dorsal spine; membranes of spinous portion of dorsal fin not deeply incised, those between longest dorsal spines extend four-fifths or more of distance from base to tips of spines; palatine teeth absent. **Paracirrhites** (p. 404)

6b. Rows of large scales above lateral line in middle of body 3 or 4; a tuft of cirri from membrane near tip of each dorsal spine; membranes of spinous portion of dorsal fin deeply incised, those between longest spines extend less than two-thirds of distance from base to tips of spines; palatine teeth present or absent.

7a. Dorsal soft rays 14 (rarely 15); first 2 pectoral rays unbranched; free posterior margin on preorbital; interorbital not scaled; snout not pointed, the profile from interorbital to upper lip convex. . . . . **Cirrhitops** (p. 419)

7b. Dorsal soft rays 11 or 12 (rarely 13); first pectoral ray unbranched, second usually branched; free posterior margin on preorbital present or absent; interorbital scaled or not scaled; snout pointed or not pointed.

8a. Palatine teeth absent; longest dorsal spine 3.5 to 4 in depth; snout not pointed, profile from interorbital to upper lip convex . . . . . **Isocirrhitus,** new genus (p. 422)

8b. Palatine teeth present; longest dorsal spine 1.7 to 3.2 in depth; snout pointed, profile from interorbital to upper lip nearly straight.

9a. Preopercular margin finely serrate; preorbital without a free hind margin; interorbital scaled; first dorsal soft ray not produced into a filament; lower 5 (rarely 6) pectoral rays unbranched . . . . . **Amblycirrhitus** (p. 423)

9b. Preopercular margin coarsely serrate; preorbital with hind margin free for about ¼ to ½ distance from lower edge to eye; interorbital not scaled; first dorsal soft ray usually produced into a filament; lower 6 or 7 pectoral rays unbranched . . . . . **Cirrhitichthys** (p. 429)

3b. Caudal fin lunate, the lobes produced; dorsal soft rays 16 or 17. **Cyprinocirrhites** (p. 443)

2b. Snout elongate, its length about 2 in head length; body slender, the depth 4.4 to 4.6 in standard length; canine teeth in jaws only slightly longer than inner villiform teeth and nearly uniform in size. **Oxycirrhites** (p. 445)

Subfamily Isobuninae

Genus *Isobuna* Jordan

Isobuna Jordan, *in* Jordan and Herre, 1907, Proc. U.S. Nat. Mus., vol. 33, p. 158. (Type species, *Paracirrhites japonicus* Steindachner, by original designation and monotypy. New name for *Paracirrhites* Steindachner, preoccupied by *Paracirrhites* Bleeker.)

Isobuna is apparently known from one specimen of a single species, *japonica* Steindachner (for a description, see species account below), which was deposited in the Museo Civico di Storia Naturale in Milan, Italy; M. Torchio of this institution has written that he is unable to locate the type and is certain that it was destroyed as a result of bombardment during World War II. It has not been illustrated.

Of this genus, Smith (1951, p. 626) stated, "If it is a cirrhitid, *Isobuna* would merit subfamily rank." It is here considered as a subfamily of the Cirrhitidae, but not with assurance. With its ctenoid scales, three opercular spines, large mouth, and lower pectoral rays unbranched but not thickened, it may represent primitive stock of the family, and it seems to link the Cirrhitidae with the Serranidae.

Isobuna japonica (Steindachner)

Paracirrhites japonicus Steindachner, *in* Steindachner and Döderlein, 1884, Denkschr. Akad. Wiss. Wien, vol. 48, p. 25 (type locality, Japan).

DESCRIPTION.—Dorsal rays X,15; anal rays III,7; lower 6 or 7 pectoral rays unbranched; lateral-line scales 33 or 34; 2 scales above lateral line; 10 scales below lateral line.

Head length slightly more than 2½ and body depth almost 2⅔ in body length. Eye 5, interorbital 8, and snout including lower jaw nearly 4 in head length.

Body compressed; upper profile of head and body moderately arched; snout pointed, the lower jaw projecting slightly; ventral outline to anal fin nearly straight. Mouth large, oblique, the maxillary extending a little beyond posterior edge of eye; teeth in jaws slender, pointed, those of outer row slightly longer and stouter than those of inner row; a small canine on each side at front of premaxillary; teeth on vomer and palatines; free preopercular margin rounded and finely serrate; operculum terminates in 3 short spines, the middle one the sharpest; lateral line almost parallel to base of dorsal fin; scales ctenoid; head scaled except for lips and a narrow band on snout to nostrils; scales on cheek and operculum large, those on top of head small; basal part of fins scaled; dorsal fin deeply notched between spinous and soft portions; fifth and sixth dorsal spines the highest, their length two-sevenths head length; last dorsal spine equal in height to first and about half diameter of eye; first soft ray as long as longest dorsal spine; the following rays up to the eighth increase gradually in length, the eighth 2⅕ in head length; remaining rays decrease gradually in length, the last 3 times in head; caudal fin weakly concave, its length 1⅘ head length. Second anal spine longer and stouter than other spines, its length slightly longer than longest dorsal spine; fourth soft ray of anal fin the longest, its length half the head length; pelvic fins not quite reaching anus, their origin in

front of lowest pectoral rays; eighth and ninth rays of pectoral fins the longest, reaching to a vertical at base of fourth anal soft ray; length of pectoral fins 1⅛ length of pelvic fins, 1½ in head length.

Color yellowish brown with a diffuse golden yellow spot in the center of each body scale (after Steindachner).

Described from a single 150 mm. specimen from Japan. The total number of pectoral rays, number of gill rakers, number of vertebrae, presence or absence of air bladder, and presence or absence of cirri distally on dorsal fin membranes and at rear edge of anterior nostril are not known.

Subfamily Cirrhitinae

Genus *Cirrhitus* Lacépède

Cirrhitus Lacépède, 1803, Histoire naturelle des poissons, vol. 5, p. 2. (Type species, *Cirrhitus maculatus* Lacépède by monotypy = *Labrus pinnulatus* Schneider. Spelled *Cirrhites* by some authors.)

Diagnosis.—Uppermost and lower 7 pectoral rays unbranched; dorsal soft rays 11 or 12; palatine teeth present; upper margin of preopercle finely serrate or smooth; preorbital without a free hind edge; small scales on cheek; 4 rows of large scales above lateral line in middle of body; depth of body 2.6 to 3.4 in standard length; snout length 2.7 to 3.8 in head length; a tuft of cirri from membrane near tip of each dorsal spine; membranes of dorsal fin not deeply incised, the one between fifth and sixth spines notched one-third or less of the length of the spines; longest dorsal spine 2.2 to 3 in body depth; pectoral fins do not reach origin of anal fin; pelvic fins reach or nearly reach anus; caudal fin slightly emarginate to slightly rounded.

Key to the Species of *Cirrhitus*

1a. Lateral-line scales 38 to 44.
  2a. Supraorbital ridge low; pectoral fins not reaching vertical at tips of pelvic fins; longest unbranched pectoral rays only slightly longer than longest branched rays.
    3a. Supraoccipital crest visible as a low ridge; no scales on interorbital space; no small white spots on head, body, and fins (white blotches nearly as large as eye present on body) (Indo-Pacific) . . **pinnulatus**
    3b. Supraoccipital crest not visible externally; a narrow median band of scales on interorbital space; small white spots on head, body, and fins, those on body arranged in about 12 lengthwise rows (Niuafoo Island, near Tonga Islands) . . . . . **albopunctatus**
  2b. Supraorbital ridge high and prominent; pectoral fins reach slightly posterior to vertical at tips of pelvic fins; longest unbranched pectoral rays nearly one-third longer than longest branched rays.
    4a. Supraorbital crest not hooklike and extending more than half an eye diameter in distance posterior to eye; scales on thorax not markedly

smaller than those on rest of body; dorsal soft rays 11; upper two-thirds of body, head, and pectoral base with scattered small solid black spots (western Indian Ocean) . . . . . **punctatus**

4b. Supraorbital crest slightly hooked posteriorly and extending only slightly posterior to eye; scales on thorax markedly smaller than those on rest of body; dorsal soft rays 12; no small solid black spots on upper part of body or head (Lord Howe Island) . . . . . **splendens**

1b. Lateral-line scales 45 to 49.

5a. Depth of body 2.6 to 2.8 in standard length; longest dorsal spine about 3.3 in head length; 5 near-vertical dark bars on body of young which break up into groups of irregular oblong spots with bicolored border (black inwardly and pale outwardly) on adults; dark bands on head with similar border (tropical eastern Pacific) . . . . . **rivulatus**

5b. Depth of body about 3 in standard length; longest dorsal spine about 2.4 in head length; color pattern not of dark bars or oblong black spots arranged in bars (Ilheo das Rolas, tropical west Africa) . . **atlanticus**

Cirrhitus pinnulatus (Schneider)

FIGURE 2

Labrus pinnulatus Schneider, *in* Bloch and Schneider, 1801, Systema ichthyologiae . . . , p. 264 (type locality, Tahiti).

Labrus marmoratus Lacépède, 1802, Histoire naturelle des poissons, vol. 3, pp. 438, 493, pl. 5, lower figure (no locality).

Cirrhitus maculatus Lacépède, 1803, Histoire naturelle des poissons, vol. 5, pp. 2, 3 (type locality, Mauritius).

Cirrhites maculosus Bennett, 1828, Zool. Journ., vol. 4, p. 38 (type locality, Hawaiian Islands).

Cirrhitus alternatus Gill, 1862, Proc. Acad. Nat. Sci. Philadelphia, vol. 14, pp. 106, 107 (type locality, Hawaiian Islands).

Cirrhitus spilotoceps Schultz, 1950, Proc. U.S. Nat. Mus., vol. 100, pp. 548, 551, pl. 13,C (type locality, Red Sea).

DIAGNOSIS.—Dorsal rays X,11; anal rays III,6; pectoral rays i,6,vii; lateral-line scales 39 to 44 (table 1); 4 rows of large scales above lateral line in middle of body (3 beneath soft portion of dorsal fin); 9 large scales below lateral line to origin of anal fin; gill rakers 5 to 7+1+11 to 13 (29 specimens, localities of table 1).

TABLE 1.—*Counts of lateral-line scales of specimens of* Cirrhitus pinnulatus

Locality	Lateral-line scales (both sides counted)					
	39	40	41	42	43	44
Hawaiian Islands	4	8	4	1	1	–
Gilbert, Marshall and Tuamotu Islands	5	11	8	2	–	–
Mauritius	1	2	1	–	–	–
Red Sea	–	–	–	3	4	3

Supraorbital ridge low; supraoccipital crest visible as a low ridge; pectoral fin tips do not reach vertical at distal ends of pelvic fins; interorbital not scaled; depth of body about 3 in standard length.

Color in alcohol brown with 3 rows of 5 or 6 white spots of the size of the eye or slightly smaller; brown area of body overlaid with close-set dark brown spots; head with dark brown blotches or irregular bands, usually the most prominent being a dark blotch behind lower edge of eye; a dark spot medially on chin adjacent to lower lip, rimmed posteriorly by an arc of dark brown; dorsal cirri white. In life the dark brown spots on the body are brownish red, the markings on the head orange-brown, and the abdomen white.

A 22-mm. juvenile from Morotai, East Indies (USNM 147682), is colored nearly like adults. The rows of white spots are more prominent; the intervening brown areas are dark and no darker spots are visible on them; the darkest marking is a broad extension of dark brown into base of dorsal fin at juncture of spinous and soft portions.

Remarks.—A wide-ranging species, *C. pinnulatus* is known throughout the Indo-Pacific. Jordan and Herre (1907) and Kamohara (1954) have recorded it from southern Japan. The author collected it in Hawaii, Gilbert Islands, Society Islands, and Tuamotu Archipelago. It is an inshore species, characteristically found in a region subject to wave action. Klunzinger (1870) and Harry (1953) have pointed out that this hawkfish hides in crevices on the reef front by day and forages on the reef by night.

The type of *pinnulatus* was not located; it is not in the Berlin museum. A specimen listed as the type of *maculatus* Lacépède from Mauritius via Dussumier (MNHN 2775) proved to be the same as *pinnulatus*. M. L. Bauchot of the Paris museum has informed the author that the true type of *maculatus* should be the *maculatus* of Commerson whose manuscript was the basis for Lacépède's name. She located this specimen (MNHN 5449A), a dried half-example measuring 172 mm. in standard length. Although no color pattern is apparent, the specimen is evidently conspecific with *pinnulatus*.

Schultz (1950; pp. 548, 551, pl. 13,C) noted slight differences in the number of lateral-line scales, gill rakers, and color of *pinnulatus* in the Red Sea. The scale counts of Red Sea specimens are higher (see table 1), and the gill rakers on the lower limb of the first arch seem to be slightly higher (12 or 13, as opposed to 11 or 12); the brown spots on the cheek, snout, and upper lip are more numerous and more distinct. Schultz has assigned the specific name *spilotoceps* to this geographical variant. I would prefer to utilize this name for subspecific designation.

Some authors have applied the name *alternatus* Gill to *pinnulatus* in Hawaii. The differentiation of the Hawaiian form is less marked

than that of the Red Sea form. Color differences are slight; there appear to be 5 or 6 gill rakers on the upper limb of the gill arch instead of 6 or 7. Should a name be desired for the Hawaiian variant, *maculosus* Bennett (1828) would have priority over *alternatus*.

In the same year that Bennett proposed *maculosus*, Rüppell applied this name to *pinnulatus* in the Red Sea; however he attributed *maculosus* to Lacépède. Lacépède's name was *maculatus*. In a later work Rüppell (1835, p. 95) indicated this mistake to be a printer's error.

Largest specimen examined, 230 mm. in standard length, from Hawaii.

Cirrhitus albopunctatus Schultz

FIGURE 3

Cirrhitus albopunctatus Schultz, 1950, Proc. U.S. Nat. Mus., vol. 100, pp. 547, 548, pl. 13,A (type locality, Niuafoo Island, near Tonga Islands).

DIAGNOSIS.—Dorsal rays X,11 or 12; anal rays III,6; pectoral rays i,6,vii; lateral-line scales 39 to 42; 3 rows of large scales above lateral line in middle of body (4 beneath most of spinous portion of dorsal fin); 9 scales below lateral line to origin of anal fin; gill rakers 7+1+10 or 11 (2 specimens).

Supraorbital ridge low and not extending posterior to eye; supraoccipital crest not visible externally; pectoral fins do not reach a vertical at tips of pelvic fins; interorbital with a narrow median band of small scales; depth of body about 3.1 in standard length; caudal fin slightly rounded; snout length 3.5 in head length (3 to 3.3 for other species of *Cirrhitus*); suprascapular margin smooth (serrate on other species of *Cirrhitus*, although reduced on *pinnulatus*) (*atlanticus* not checked).

Color in alcohol brown with small white spots on head, body, and fins, those on body in about 12 rows. These small white spots are superimposed on a pattern of about 4 rows of pale spots about the size of the eye, the 2 most prominent spots being at the base of the caudal fin; uppermost of these 2 white spots edged with dark brown blotches, the largest of which lies dorsally on caudal peduncle.

REMARKS.—Known from 2 specimens from Niuafoo Island near the Tonga Islands, the holotype (USNM 91883), 101 mm. in standard length and an 80 mm. paratype, now in the Museum of Comparative Zoology at Harvard University.

Cirrhitus punctatus Cuvier

FIGURE 4

Cirrhites punctatus Cuvier, *in* Cuvier and Valenciennes, 1829, Histoire naturelle des poissons, vol. 3, p. 70 (type locality, Madagascar).

Cirrhites punctatus Bleeker, 1866, Nederlandsch Tijdschr. Dierk., vol. 3, p. 176 (Réunion).

Cirrhitus nigropunctatus Schultz, 1950, Proc. U. S. Nat. Mus., vol. 100, pp. 547, 549, pl. 13,B (type locality, Mauritius).

Cirrhitus mossambicus Smith, 1951, Ann. Mag. Nat. Hist., ser. 2, vol. 4, p. 629, fig. 1 (type locality, Mozambique Island, east Africa).

DIAGNOSIS.—Dorsal rays X,11; anal rays III,6; pectoral rays i,6,vii; lateral-line scales 40 to 43; 4 rows of large scales above lateral line in middle of body; 9 large scales below lateral line to origin of anal fin; gill rakers 6 or 7+1+10 or 11 (5 specimens, Mauritius and Madagascar).

Prominent bony supraorbital ridge extending more than half an eye diameter posterior to eye; pectoral fins reach beyond tips of pelvic fins; interorbital scaled; depth of body 3.14 to 3.35 in standard length; caudal fin truncate to slightly rounded.

Color in alcohol: upper half of body with large dark and pale blotches forming 5 alternate dark and light bars, lower half pale with a series of 5 dark blotches; upper two-thirds of body, head, and pectoral base with scattered small dark brown or black spots; a curved dark line extending posteriorly from eye; a dark blotch on lower lip; all fins blotched with dark brown.

REMARKS.—The type of *punctatus* (MNHN 2772) was obtained from Madagascar by Quoy and Gaimard. The following counts and measurements were made from the specimen: lateral-line scales 43; gill rakers 6+1+10; standard length 136 mm., total length 167 mm., depth 43.5 mm., head length 51.5 mm., eye diameter 9.5 mm., length of pectoral fin 41 mm., longest dorsal spine (the third) 19 mm. Sixteen canine teeth on one side at front of upper jaw; 6 lower canines, the last 2 the longest, followed by 11 shorter, more slender teeth of about equal height. Inner rows of villiform teeth extend the length of upper jaw but are restricted to anterior part of lower jaw; palatine teeth in 2 short anterior irregular rows.

Another specimen in the museum in Paris is also listed as a type. This is a dried, varnished, 132.5-mm. half-specimen, with a locality of "Mer des Indes" (Indian Ocean) and attributed to Commerson. The Madagascar specimen is well preserved in alcohol and is here designated lectotype.

The largest specimen examined, 149 mm. in standard length, is a paratype of *nigropunctatus* Schultz from Mauritius in the Museum of Comparative Zoology at Harvard University. The holotype of *nigropunctatus* was examined and photographed in the U.S. National Museum.

The species is apparently known only from the localities listed in the citations above, which suggest that it is restricted to the western Indian Ocean.

Cirrhitus splendens (Ogilby)

FIGURE 5

Cirrhitichthys splendens Ogilby, 1889, Mem. Australian Mus., no. 2, p. 58, pl. 2 (type locality, Lord Howe Island).

DIAGNOSIS.—Dorsal rays X,12; anal rays III,6; pectoral rays i,6,vii; lateral-line scales 43; 4 rows of large scales above lateral line in middle of body; 9 scales below lateral line to origin of anal fin; gill rakers 5+1+10 (1 specimen).

Bony supraorbital ridge moderately high, the hind edge slightly hooked (that is, upper portion overhanging base), but extending only slightly posterior to eye; scales on thorax markedly smaller than those on rest of body (scales essentially the same size on thorax as on body of other species of *Cirrhitus*) (*atlanticus* not checked); pectoral fins extending beyond pelvic fin tips and posterior to anus, but do not reach origin of anal fin; longest unbranched pectoral ray nearly one-third longer than longest branched ray; interorbital deeply concave, unscaled; snout length about 2.7 in head length; longest dorsal spine about 2.2 in body depth; depth of body about 3.2 in standard length; small scales on thorax like those on cheek; first dorsal soft ray noticeably longer than remaining rays (decidedly longer on type) (other species of *Cirrhitus* lack prolonged first dorsal soft rays); upper half of preopercular margin with 26 serrations which are larger than those in species of *Cirrhitus* with serrations on the preopercle but still small compared to those in species of *Cirrhitichthys;* suprascapula with 16 serrations.

Color in alcohol brown, with 5 indistinct broad darker brown bars on about upper two-thirds of body, the last on caudal peduncle representing an aggregation of 6 dark brown spots, 3 above and 3 below lateral line; each broad bar of body divides below lateral line to 2 or 3 lesser bars (this pattern obscure for first 2 bars); head entirely covered with dark-edged pale spots the size of pupil or smaller except for a horizontally elongate one posterior to eye, a transversely elongate one on occipital part of head, and a bilobed one with broad dark border middorsally on nape; caudal fin pale with elongate black spots arranged in about 3 irregular vertical rows; spinous portion of dorsal fin with a row of 5 large dark-edged pale spots at base; upper triangular portion of each dorsal interspinous membrane black; soft portion of dorsal fin pale, except basal scaled portion which is colored like body; anal and pelvic fins light brown; pectoral fins light brown, faintly spotted basally, except outer two-thirds of the thickened simple lower rays which are abruptly pale.

The life color of the type is given by Ogilby as follows:

> The head is rich brown with numerous round crimson black-edged spots, about two-thirds of the size of a body scale; the body is pale yellowish-brown with six

broad dark brown bands which almost totally obliterate the ground color superiorly, but are discontinued on the lower third of the sides, while many of the scales above the lateral line are crimson, occasionally even forming short longitudinal bars, and in front of the bases of the pectorals there are several spots similar to those on the head; the spinous portion of the dorsal fin is mottled with black, crimson, and grey; the soft is light-colored with a broad black basal band, and indications of a dusky median longitudinal band more pronounced posteriorly; the anal fin is reddish brown; the ventral fins are crimson on the inner side, while the pectoral rays are crimson, with the intervening membrane grey; the base of the caudal is crimson, the remainder grey, and it is ornamented with two rows of oblong black spots.

Remarks.—Apparently only 2 specimens are known, both from Lord Howe Island off Australia. The type, 8¼ in. in length, is catalogued in the Australian Museum as No. I.1841. According to Ogilby, it was caught in "deep water" by hook and line and was "quite unknown to the islanders." The second specimen, 161 mm. in standard length (7¾ inches in total length), was kindly sent on loan to the author by A. C. Wheeler of the British Museum (No. 1926.6.30.88).

Cirrhitus rivulatus Valenciennes

Figure 6

Cirrhites rivulatus Valenciennes, 1855, Voyage autour du monde . . . la *Venus*, vol. 5, p. 309, pl. 3, fig. 1 (type locality, Galápagos Islands).

Cirrhitus betaurus Gill, 1862, Proc. Acad. Nat. Sci. Philadelphia, p. 259 (type locality, Cape San Lucas, Baja California).

Diagnosis.—Dorsal rays X,11 or 12; anal rays III,6; pectoral rays i,6,vii; lateral-line scales 45 to 49; 5 rows of large scales above lateral line in middle of body (6 to origin of dorsal fin and 4 beneath most of soft portion of dorsal fin); 9 scales below lateral line to origin of anal fin; gill rakers 5 to 7+1+10 to 12 (rarely 12) (14 specimens, Panama, Mexico, and Clipperton Island).

Bony supraorbital ridge low; pectoral fins do not reach tips of pelvic fins; interorbital on adults not scaled, covered with tiny papillae (juveniles seem to have a few imbedded scales on interorbital space); depth of body 2.6 to 2.8 in standard length (3 to 3.4 for other species of *Cirrhitus*); snout length of adults about 3 in head length (about 3.3 in small juveniles); longest dorsal spine about 3 in depth (4 on large adults) (2.2 to 2.7 for other species of *Cirrhitus*); caudal fin of juveniles slightly emarginate, of adults slightly rounded; upper margin of preopercle of juveniles with fine serrations, smooth on adults.

Color in alcohol brown, with irregular but usually vertically elongate spots with dark inner and pale outer edges arranged in 5 near-vertical bars on body (on juveniles these bars are solid dark brown); bands on head, mostly radiating from eye, and at pectoral

base with the same dark inner and pale outer edges; median fins also with irregular spots. Valenciennes described the life color as olive-green, the spots and bands lighter with dark olive inner and cobalt blue outer borders. The fins are olivaceous with blue rivulations.

REMARKS.—The holotype (MNHN A5563) is a dried specimen mounted on wood; the length given by Valenciennes is 445 mm.

C. rivulatus is probably the largest species of the family. Tee-Van (1940) recorded a specimen 450 mm. in total length (his addendum report of a 505-mm. specimen from the Galápagos Islands, USNM 38302, is erroneous; this specimen measures 360 mm. in total length). Another USNM specimen (144465) from Bona Island, Panama is 520 mm. in total length and 430 mm. in standard length.

Gregory (1933; p. 259, fig. 135) has briefly described the osteology of *rivulatus*. Widely distributed in the tropical eastern Pacific.

Cirrhitus atlanticus Osorio

FIGURE 7

Cirrhitus atlanticus Osorio, 1893, Jorn. Sci. Math. Phys. Nat. [Acad. Sci. Lisboa], ser. 2, vol. 3, p. 138 (type locality, Ilheo das Rolas, west Africa).

DIAGNOSIS.—Dorsal rays X,11; anal rays III,6; pectoral rays i,6,vii; lateral-line scales 46 (47); 4 rows of large scales above lateral line in middle of body; 10 scales below lateral line to origin of anal fin; gill rakers 5+1+13 (1 specimen).

Bony supraorbital ridge low and not extending posterior to eye; pectoral fins do not reach tips of pelvics; small scales on interorbital space; depth of body about 3 in standard length; longest dorsal spine about 2.3 in depth; caudal fin slightly emarginate.

Color in alcohol brown, the upper half of the body darker, especially posteriorly, and containing 4 pale blotches at base of dorsal fin; first white blotch centered at base of eighth dorsal spine, the second, somewhat larger (slightly larger than eye) and roughly square in shape, located from base of second to fifth dorsal soft rays, the third at base of last 3 dorsal soft rays, and the last dorsally on caudal peduncle; no irregular white spots on head, as described by Osorio, are now visible, and the row of white spots below the lateral line mentioned in his description is now very faint.

REMARKS.—The type (No. 510), which was examined at the Museu e Laboratório Zoológico in Lisbon, is in good condition. The following measurements and notations were made from the specimen: standard length 155.5 mm.; total length 192 mm.; depth 51 mm.; head 54 mm.; width 23 mm.; eye 9.5 mm.; bony interorbital 8 mm.; pectoral fin 40 mm., longest dorsal spines (fourth to sixth) 22 mm.; first dorsal soft ray 23 mm.; upper margin of preopercle finely serrate,

lower smooth; 7 large scales on opercle with small scales anteriorly and on opercular flap; small scales on interopercle; no scales on gill membranes.

Apparently known only from the type collected at Ilheo das Rolas (0°0′ N., 6°32′ E.), west Africa. The only cirrhitid fish recorded from the eastern Atlantic.

Genus *Neocirrhites* Castelnau

Neocirrhites Castelnau, 1873, Proc. Zool. Acclim. Soc. Victoria, vol. 2, p. 101. (Type species, *Neocirrhites armatus* Castelnau, by monotypy).

Hughichthys Schultz, 1943, U.S. Nat. Mus. Bull. 180, p. 136. (Type species, *Cirrhites melanotus* Günther, by original designation and monotypy).

Generic characters are given in the key to the genera and the diagnosis of the single species, which follows.

Neocirrhites armatus Castelnau

FIGURE 8

Neocirrhites armatus Castelnau, 1873, Proc. Zool. Acclim. Soc. Victoria, vol. 2, p. 101 (type locality, Nob Island, east of Cape Grenville, northeastern Australia).

Cirrhites melanotus Günther, 1874, Fische der Südsee, vol. 1, pt. 3, p. 72, pl. 52, C (type locality, Society Islands).

Paracirrhites melanotus Fowler and Ball, 1925, Bull. B. P. Bishop Mus. 26, p. 16 (Wake Island).

Hughichthys melanotus Schultz, 1943, U.S. Nat. Mus. Bull. 180, p. 136 (Hull Island, Phoenix Islands).

DIAGNOSIS.—Dorsal rays X,13; anal rays III,6 or 7 (one with 7); pectoral rays i,7,vi; lateral-line scales 42 to 45; 4 rows of large scales above lateral line in middle of body (6 to origin of dorsal fin); 10 or 11 scales below lateral line to origin of anal fin; gill rakers 5+1+10 or 11 (12 specimens, Society Islands and Caroline Atoll).

Palatine teeth absent; margin of preopercle with about 12 coarse serrations; preorbital without a free hind margin; small scales on cheek in more than 12 irregular rows; interorbital space not scaled; 4 rows of large scales above lateral line in middle of body (6 to origin of dorsal fin); body deep and compressed, the depth 2 to 2.4 in standard length and the width 2.9 to 3.1 in depth; a tuft of cirri from membrane near tip of each dorsal spine; dorsal spines short, the longest about 3.2 to 3.8 in depth; membranes of dorsal fin not deeply incised, that between fifth and sixth dorsal spines notched less than one-fourth length of spines; first dorsal soft ray not prolonged into a filament; pectoral fins do not reach tips of pelvic fins; pelvic fins reach anus; caudal fin slightly rounded.

Color in alcohol light brown, the upper fifth abruptly dark brown; a large dark brown blotch encircling posterior half of eye; a dark spot on tip of snout and lower lip; fins pale except basal part of dorsal fin which is dark brown.

Color in life of a specimen collected by the author at Caroline Atoll (10°S.,150°W.): body brilliant red except upper fourth to fifth which is dark brown, the demarcation of red and brown not as abrupt as dark and light brown of preserved specimens; head red like body except dorsally on tip of snout, front of lower lip, and a large area adjacent to posterior edge of eye which are dark brown; all fins bright red except dorsal, the spinous portion of which is dark brown up to tips of membranes which are red-orange; soft portion of dorsal fin dark brown on basal third, red-orange on outer two-thirds.

Remarks.—The type of *armatus* was not located. Gilbert P. Whitley has written that it is not in the Australian Museum. There is no record of it at the Muséum National d'Histoire Naturelle in Paris.

The minute scales on the cheek, lack of teeth on palatines, height a little over 2⅕ in total length, preopercle armed with a series of stout spines, 10 dorsal spines of about equal length except the first which is much shorter, 13 dorsal rays, 6 simple pectoral rays, 43 lateral-line scales, 16 rows of scales in vertical series, and light brownish color with the back darker, all mentioned in the original description by Castelnau, are diagnostic for the hawkfish subsequently named *melanotus* by Günther (1874).

N. armatus is known from northeast Australia, Society Islands, Wake Island, Phoenix Islands and Caroline Atoll. Harry (1953, p. 89) recorded it from Raroia, Tuamotu Archipelago as an undetermined genus and species. Fowler (1931) (after Pohl) listed it from Mortlock (Caroline Islands) by name only.

A small species, the largest specimen examined measures 75 mm. in standard length.

Genus *Paracirrhites* Bleeker

Paracirrhites Bleeker, 1875 Verh. Akad. Wettensch., Amsterdam, vol. 15 (1874), pp. 2, 5. (Type species, *Grammistes forsteri* Schneider, by monotypy).

Gymnocirrhites Smith, 1951, Ann. Mag. Nat. Hist., ser. 12, vol. 4, pp. 627, 638. (Type species, *Cirrhites arcatus* Cuvier, by original designation).

Diagnosis.—Upper 1 or 2 and lower 7 (rarely 6) pectoral rays unbranched; dorsal soft rays 11; palatine teeth absent; upper margin of preopercle very finely serrate or smooth; serration on suprascapula reduced (well-developed in other genera except for *Isocirrhitus* and

some species of *Cirrhitus* and *Amblycirrhitus*); preorbital without a free hind edge; 5 or 6 rows of large scales on cheek; cheek scales with small basal scales; interorbital scaled; 5 rows of large scales above lateral line to spinous portion of dorsal fin (scales in upper row become smaller beneath soft portion of fin); depth of body 2.4 to 3.2 in standard length; snout length 2.7 to 3.6 in head length; a single cirrus from membrane near tip of each dorsal spine; membranes of dorsal fin not deeply incised, the one between fifth and sixth dorsal spines notched less than one-fifth of the length of spines; longest dorsal spine 2.8 to 3.8 in body depth; pectoral fins short, their length about 1.5 to 2 in head length, and not reaching tips of pelvic fins; unbranched pectoral rays only slightly longer than branched rays of fin; caudal fin truncate to rounded.

Remarks.—Smith (1951) erected the genus *Gymnocirrhites*, designating *arcatus* as the type species. He distinguished it from *Paracirrhites* by the naked membranous fold across the throat and by the lack of scales on the snout before the nostrils. D. W. Strasburg, in an unpublished report on the fishes of the southern Marshall Islands submitted to the Office of Naval Research Aug. 11, 1953, noted the presence of imbedded scales on the gill membranes over the isthmus of some specimens of *arcatus* (and of *hemistictus* as well). Randall (1955, p. 196) placed *Gymnocirrhites* in synonymy. Schultz (Schultz and collaborators, 1960, p. 252) stated that *arcatus* lacks scales on the gill membranes at 48 mm. but has them well developed at 100 mm. standard length. The absence of scales anterior to the nostrils is characteristic of *arcatus*; however, this distinction would not seem to be of generic rank. At least 3 of the 4 other species with postocular marks similar to that of *arcatus* (these species certainly belonging in the same genus as *arcatus*) have scales on the snout anterior to the nostrils (although not as many and none over the median process of the premaxillary as is seen on *forsteri*).

Key to the Species of *Paracirrhites*

1a. Second pectoral ray branched, at least near tip; scales on snout anterior to nostrils; no color mark extending diagonally upward from hind edge of eye.
  2a. Ninth and tenth dorsal spines subequal (the tenth slightly longer); lateral-line scales 45 to 49; small dark spots, if present, located on head and anteriorly on body.
    3a. Depth of body 2.6 to 2.8 in standard length; small scales on cheek do not separate rows of large scales or adjacent large scales within rows; numerous small dark spots on head and anteriorly on body; no vertical dark bars on body; no pale lines on ventral half of body following scale rows (Indo-Pacific) . . . . . **forsteri**

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3b. Depth of body about 2.9 in standard length; small scales surround large scales on cheek, separating the rows and adjacent scales within rows; no small dark spots visible on head or anteriorly on body; about 9 slightly irregular dark bars on body; ventral half of body with pale lines following scale rows (Nuku Hiva, Marquesas Islands). **typee,** new species

2b. Tenth dorsal spine noticeably longer than ninth spine; lateral-line scales 48 to 51; numerous small dark spots on body, but none on head (central Pacific, excluding Hawaii, and Cocos-Keeling Islands). . **hemistictus**

1b. Second pectoral ray unbranched; no scales on snout anterior to nostrils; a prominent elongate solid or U-shaped mark extending diagonally upward from hind edge of eye.

4a. Three dark-edged pale transverse bands on interopercle; postocular mark not black within U-shaped border; a lengthwise pale band lacking a dark border often present on body; lateral-line scales 45 to 50 (Indo-Pacific) . . . . . **arcatus**

4b. No transverse bands on interopercle; postocular mark dark brown or black within U-shaped border; if a lengthwise pale band is present on body, it is broadly bordered with black; lateral-line scales 48 to 52.

5a. Body uniformly pale or pale with faint lengthwise brown lines following scale rows; lower border of postocular mark does not extend to and beyond lower edge of eye; no dark-edged white spots anteriorly on snout; no markings on maxillary; no white spot in vicinity of anterior nostril.

6a. Posterior margin of caudal fin rounded; postocular mark broader than pupil and originating above center of hind edge of eye; color of body in life orange-red (after Bleeker) (East Indies) . . . **amblycephalus**

6b. Posterior margin of caudal fin straight; postocular mark narrower than pupil and originating at or below center of hind edge of eye; color in life bright yellow (Society and Tuamotu Islands, and Caroline Atoll). **xanthus,** new species

5b. Body not uniformly pale; lower border of postocular spot extends past lower edge of eye almost to upper lip; a pair of dark-edged white spots anteriorly on snout near upper lip; 1 or more small markings on maxillary; anterior nostril nearly enclosed in a white spot.

7a. Body light brown; a lengthwise pale band, broadly bordered with black (except anteriorly), enclosing posterior part of lateral line and running from beneath rear of spinous portion of dorsal fin to middle of caudal fin; upper margin of preopercle smooth or with only a few small serrations (Tuamotu Archipelago) . . . . **nisus,** new species

7b. Body dark brown except caudal peduncle and extreme ventral portion of body posterior to insertion of pelvic fins which are pale yellowish; no lengthwise pale band on body; upper margin of preopercle finely serrate (Caroline Atoll) . . . . . **bicolor,** new species

Paracirrhites forsteri (Schneider)

FIGURE 9

Grammistes forsteri Schneider, *in* Bloch and Schneider, 1801, Systema ichthyologiae . . . , p. 191 (type locality, St. Christine=Tahuata, Marquesas Islands).

Sparus pantherinus Lacépède, 1802, Histoire naturelle des poissons, vol. 4, p. 160, pl. 6, lower figure (no locality).

Gerranus tankervillae Bennett, 1834, A selection of the fishes . . . Ceylon, ed. 2, p. 27, pl. 27 (type locality, Ceylon).

DIAGNOSIS.—Dorsal rays X,11; anal rays III,6; pectoral rays i,6,vii; lateral-line scales 45 to 49; 5 rows of large scales between lateral line and spinous portion of dorsal fin; 11 large scales below lateral line to origin of anal fin; gill rakers 5 or 6+1+10 to 12 (28 specimens, Gilbert Islands, Mauritius, Formosa, and French Oceania).

Snout almost entirely scaled; depth of body 2.6 to 2.8 in standard length; width of body about 2.2 in depth; upper two-fifths of free margin of preopercle very finely serrate; a slight concavity in margin of preopercle just below upper serrate portion; ninth and tenth dorsal spines nearly equal; small scales on cheek do not isolate rows of large scales or individual large scales from one another.

Color in alcohol light brown, with a broad dark brown band along the back, the lower edge of which approximately coincides with lateral line; entire head, nape, pectoral base, and chest with small black spots. The usual color in life pale yellow dorsally and on sides, abruptly pale pinkish tan ventrally, with a broad dark band from eye to base of caudal fin dividing the yellow area of the back into narrow upper and broad lower bands; dark band begins on head as reddish brown or purplish and becomes dark brown or black on posterior two-thirds of body; numerous dark reddish-brown spots over head and anterior part of body; dorsal, caudal, and pectoral fins pink; anal and pelvic fins yellowish. On some specimens the dark band is obscure. Specimens occasionally have a series of large cojoined black spots on the posterior two-thirds of the body as portrayed by Bleeker (1876–77, pl. 149, fig. 5) instead of a uniform lengthwise band. A 58 mm. specimen collected by the author in Moorea was entirely white on the head and body below the dark band. The spots on the head were small and bright red except for those on the lighter anterior portion of the dark band which were black.

REMARKS.—One of the more abundant and widespread of the cirrhitids, *P. forsteri* is known from east Africa to Polynesia. This species has been collected by the author in the Hawaiian Islands, Gilbert Islands, Society Islands, and the Marquesas. In addition to these localities, specimens were examined in the U.S. National Museum from the Philippines, Formosa (collected by R. E. Kuntz), Ryukyu Islands, Fiji, Solomon Islands and New Hebrides (collected by W. M. Chapman), Palau Islands (collected by E. Clark), and Marshall Islands. The Museum of Comparative Zoology at Harvard University has specimens from the Red Sea and Mauritius. The largest specimen examined is 172 mm. in standard length, from Hawaii.

The type of *P. forsteri* was not located. Günther has given a brief description of the osteology of this species.

***Paracirrhites typee*, new species**

FIGURE 10

HOLOTYPE.—MNHN 2908, 157.5 mm. in standard length, Nuku Hiva, Marquesas Islands, *Zélée* expedition, under command of Dumont d'Urville; probable collector, H. Jacquinot, late August–early September, 1838.

DESCRIPTION.—Dorsal rays X,11; anal rays III,6; pectoral rays i,6,vii, lateral-line scales 49 (48); 5 rows of large scales between lateral line and spinous portion of dorsal fin; 10 scales below lateral line to origin of anal fin; gill rakers 6+1+11.

Each of the following measurements is given as a percentage of the standard length: greatest depth of body 34.3; width of body at gill opening 15.7; head length 34.1; snout length 12.1; eye diameter 5.6; postorbital length of head 18.8; bony interorbital space 5.7; least depth of caudal peduncle 13.3; length of caudal peduncle 14.9; snout to origin of dorsal fin 37.7; snout to origin of anal fin 67.8; snout to origin of pelvic fin 43.4; length of dorsal fin base 54.7; length of anal fin base 16.9; length of pectoral fin 17.5; length of pelvic fin 18.2; length of pelvic spine 10.2; length of first dorsal spine 6.4; length of longest (fifth and sixth) dorsal spines 11.9; length of ninth dorsal spine 8.0; length of tenth dorsal spine 8.3; tips of dorsal soft rays broken; length of first anal spine 7.8; length of second anal spine 12.7; length of third anal spine 10.8; tips of anal soft rays broken; ends of caudal rays broken (longest existing rays 19.1 percent of standard length).

In addition to those of the family and genus, the following characters apply to this species: interorbital slightly concave, fully scaled; snout entirely scaled except for narrow region just above upper lip; 5 straight rows of large scales on cheek; small scales surround large scales on cheek separating the rows and isolating adjacent scales within rows (possibly this character will not hold in smaller specimens); 6 large scales on opercle with small basal scales; region of large scales on opercle surrounded by small scales; small scales on free fold of gill membranes that passes over isthmus; interopercle covered with small scales; 10 rows of scales above lateral line on caudal peduncle on one side to lateral line on other; about 11 median predorsal scales; small scales basally on fins; maxillary extends to a vertical at center of eye; upper two-fifths of free margin of preopercle finely serrate (about 43 serrations); a slight concavity in free margin of preopercle just below serrate portion; pelvic fin tips not reaching anus; tenth dorsal spine

only slightly longer than ninth spine; third of lower 7 unbranched pectoral rays the longest; shape of caudal fin, though unknown because of broken tips, probably truncate or slightly rounded; hind flap on anterior nostril with about 18 cirri.

Color in alcohol brown, with 9 irregular slightly diagonal dark brown bars, the first on nape and the last at base of caudal fin; faint longitudinal pale lines following centers of scale rows, these most evident below lateral line (lines appear to be formed by white connective tissue beneath a scale at the juncture of the two scales that it overlaps); fins light brown. Life color unknown.

Remarks.—This species is morphologically similar to *P. forsteri* and *P. hemistictus* (see Key), but very different in color.

It is apparently known only from the holotype which was collected in Nuku Hiva by the *Zélée* expedition in 1838. During a brief stay in the Marquesas Islands, the author noted that this island group, although possessing essentially an impoverished Indo-Pacific fish fauna, appears to have a moderate number of endemic species; however, these species do not approach in magnitude the endemism of the shore fishes of the Hawaiian Islands. *P. typee* may prove to be an example of one of these indigenous forms.

Paracirrhites hemistictus (Günther)

Figures 11, 12

Cirrhites hemistictus Günther, 1874, Fische der Südsee, vol. 1, pt. 3, p. 69, pl. 50, B (type locality, Raiatea, Society Islands).

Cirrhites polystictus Günther, 1874, Fische der Südsee, vol. 1, pt. 3, p. 70, pl. 50, A (Society Islands).

Amblycirrhitus hemistictus Marshall, 1950, Bull. Raffles Mus., no. 22, p. 183, pl. 18 (Cocos-Keeling Islands, Indian Ocean).

Paracirrhites species one. Harry, 1953, Atoll Res. Bull. 18, p. 88 (Raroia, Tuamotus).

Paracirrhites hemistictus Schultz, *in* Schultz and collaborators, 1960, U.S. Nat. Mus. Bull. 202, vol. 2, p. 265, pls. 106,E and 111,C (Bikini Atoll, Marshall Islands).

Diagnosis.—Dorsal rays X,11; anal rays III,6; pectoral rays i,6,vii; lateral-line scales 48 to 51; 5 rows of large scales between lateral line and spinous portion of dorsal fin; 11 scales below lateral line to origin of anal fin; gill rakers 6 or 7+1+11 to 13 (9 specimens, Gilbert, Society, and Tuamotu Islands).

Snout almost entirely scaled; depth of body 2.8 to 3.2 in standard length; width of body 1.9 to 2.2 in depth (width relatively greater in larger specimens); upper two-fifths of free margin of preopercle finely serrate; a slight concavity in margin of preopercle just below serrate

portion; tenth dorsal spine noticeably longer than ninth spine; small scales on cheek do not isolate rows of large scales or individual large scales from one another.

Color in alcohol either light brown, with a median lateral lengthwise pale band and numerous dark brown spots on back, or brown, with numerous brown spots on body and a white spot about the size of the eye in the middle of the body on the lateral line.

Remarks.—Marshall (1950) reported on a single specimen 142 mm. in standard length from Cocos-Keeling which was intermediate in color pattern to the 2 nominal species *Paracirrhites hemistictus* and *P. polystictus*. This led him to a comparison of the 2 Günther types and the decision that these fishes represent a single species, *hemistictus*. Three immature specimens, 74 to 78 mm. in standard length, collected by the author in Makatea, Tuamotu Archipelago, are also intermediate in color pattern to *hemistictus* and *polystictus*, having both the pale band of the former and the pale spot of the latter.

Schultz (Schultz and collaborators, 1960) sexed 3 specimens of *hemistictus* and the 2 of *polystictus* and concluded that *polystictus* is the male of *hemistictus*. Additional determinations now reveal that the 2 color patterns are not correlated with sex. Three specimens of the *polystictus* form from 166 to 190 mm. in standard length are females, and 2 specimens of *hemistictus* 170 and 195 mm. in standard length are males.

Although these 2 forms are here treated as a single dichromatic species, the possibility that they are valid species and the intermediates are hybrids, as suggested by the author (1955, p. 198), should be investigated.

The color from a 35-mm. kodachrome taken of a 185-mm. specimen of the *hemistictus* form collected by the author at Arno Atoll in the Marshall Islands is: upper half of body grayish green, lower half greenish white, these two regions separated by a pinkish-white band; upper green part of body densely spotted with black; brownish yellow spots just beneath white band; more ventrally, lengthwise rows of yellow spots; head gray; dorsal fin dusky yellow; caudal and anal fins yellow; paired fins yellow-orange.

Color from a kodachrome of a 190-mm. specimen of the *polystictus* form from Onotoa, Gilbert Islands: head brownish lavender-red, body bluish gray with numerous close-set dark brown spots, those on ventral part of body not as large and forming lengthwise lines; a prominent bright pinkish white spot, almost as large as eye, on lateral line below base of eighth and ninth dorsal spines; median and pelvic fins dark grayish brown, the spinous portion of the dorsal fin with faint brownish orange spots; pectoral fins lavender-red proximally, bright orange distally.

The type of *hemistictus* (No. 1874.11.2.5), a specimen 153.5 mm. in standard length, from Raiatea, is in the British Museum.

This species is known in the tropical Pacific from Guam (Fowler, 1925), Phoenix Islands (Schultz, 1943), Society, Tuamotu, Gilbert, and Marshall Islands, and from one locality in the Indian Ocean, Cocos-Keeling Islands. Further collecting will probably dispel the present discontinuities in its range. Apparently the largest species of the genus; both forms are known to attain at least 190 mm. in standard length.

Two specimens at the Museum of Comparative Zoology are labelled as collected by Garrett in the Hawaiian Islands. This locality is probably an error, for Günther did not list any Garrett specimens from Hawaii, and the species has not turned up in other extensive collections from this archipelago.

Paracirrhites arcatus (Cuvier)

FIGURE 13

Cirrhites arcatus Cuvier, *in* Cuvier and Valenciennes, 1829, Histoire naturelle des poissons, vol. 3, p. 74 (type locality, Mauritius and Tahiti).

Cirrhites vittatus Cuvier, 1829, Le régne animal . . ., vol. 2, p. 146 (after Renard pl. 18, fig. 102).

DIAGNOSIS.—Dorsal rays X,11; anal rays III,6; pectoral rays ii,5,vii or ii,6,vi (usually with lower 7 rays unbranched) lateral-line scales 45 to 50 (see table 2); 5 rows of large scales between lateral line and spinous portion of dorsal fin; 11 large scales below lateral line to origin of anal fin; gill rakers 4 or 5+1+11 or 12 (20 specimens, Society and Tuamotu Islands).

TABLE 2.—*Lateral-line scales of species of* Paracirrhites *of the* arcatus *complex*

	45	46	47	48	49	50	51	52
P. arcatus (by color):								
Normal color with pale band	2	10	35	36	23	2	–	–
Melanistic without pale band	1	2	7	5	5	1	–	–
P. arcatus (by locality):								
Mauritius	–	–	1	1	–	–	–	–
Maldive Islands	–	–	–	1	1	–	–	–
Fiji	–	1	1	–	–	–	–	–
Samoa Islands	1	1	13	6	9	–	–	–
Gilbert Islands	–	1	–	3	1	–	–	–
Marshall Islands	–	5	18	13	9	1	–	–
Hawaiian Islands and Johnston Island	2	2	2	5	4	1	–	–
Society and Tuamotu Islands	–	2	7	12	4	1	–	–
P. xanthus	–	–	–	–	1	6	1	1
P. nisus	–	–	–	1	1	–	–	–
P. bicolor	–	–	–	1	–	–	[1]1	–

[1] 50 lateral-line scales on one side, 52 on other.

No scales on snout anterior to nostrils; depth of body about 2.6 in standard length; width of body about 2.7 in depth; upper margin of preopercle smooth; no concavity in preopercular margin; caudal fin truncate to slightly rounded.

The usual color in alcohol is brown with a pale lengthwise band which begins beneath spinous portion of the dorsal fin and follows the lateral line to the upper base of the caudal fin; a diagonal U-shaped mark behind eye; 2 to 4 dark-edged pale transverse bands (which may be broken into 2 or more elongate spots) on interopercle.

Color in life of specimens collected by the author in the Tuamotus: light grayish brown, the centers of the scales a little paler than edges, resulting in a faint lengthwise banding; a broad lengthwise pale pink to white band running over region of lateral line from beneath base of about the seventh dorsal spine to caudal fin; a large U-shaped area, only slightly darker than rest of head and enclosed by a tricolored border of bright orange, dark brown, and outwardly light blue, extending diagonally upward from rear of eye; three bright orange bands cross interopercle, the uppermost at edge of opercle, these bands narrowly edged with dark brown and broadly with pale blue; anterior nostril, tips of snout above upper lip, front edge of lower lip, maxillary and premaxillary groove bright orange; fins light yellowish brown.

Remarks.—Occasional specimens of *arcatus*, which may be either male or female, are dark brown and lack the lengthwise pale band on the body. Günther (1874, p. 70, pl. 49, B, C) illustrated both forms and regarded them as color varieties. Specimens intermediate in color have been examined, and no meristic differences between the two forms were ascertained (see table 2 for comparison of lateral-line scale counts); Günther's judgment, therefore, seems correct.

A syntype of *arcatus* from Mauritius (MNHN 2854) measures 82 mm. in standard length and is well preserved; it is here designated as the lectotype, and the type locality is thus restricted to Mauritius.

This Indo-Pacific species is at least as widespread and abundant as *P. forsteri*. Largest specimen examined, 111 mm. in standard length, from Hawaii.

Paracirrhites amblycephalus (Bleeker)

Figure 14

Cirrhites amblycephalus Bleeker, 1857, Natuurk. Tijdschr. Nederlandsch-Indië, vol. 13, p. 378 (type locality, Sangi Islands).

Paracirrhites amblycephalus Bleeker, 1876–77, Atlas ichthyologique . . . , vol. 8, pp. 143, 145, pl. 350, fig. 1.

Diagnosis.—Dorsal rays X,11; anal rays III,6; pectoral rays ii,5,vii; lateral-line scales 48; 5 rows of large scales between lateral line and spinous portion of dorsal fin; caudal fin strongly rounded;

depth of body about 2.6 in standard length (3¼ in total length); preopercular margin serrate, rounded, without a concavity.

Color of body orange-red with 16 to 18 brownish longitudinal streaks, one on each scale row; a U-shaped dark brown mark wider than pupil of eye and edged with orange extending diagonally upward from posterior upper half of eye (after Bleeker).

Remarks.—Known only from the Sangi Islands, between Celebes and Mindanao. This species has erroneously been placed in the synonymy of *arcatus* by some authors, probably because of its similar postocular mark.

Bleeker described a median crest on the head of *amblycephalus*, although there is no evidence of this from his figure. M. Boeseman examined the type (No. 5841), evidently the only known specimen, at the Rijksmuseum van Natuurlijke Historie at Leiden. He reported the specimen, about 78 mm. in standard length, to be in poor condition. The upper part of the head has been skeletonized, and the median crest appears to be only the bony ridge of the supraoccipital exposed by the removal of soft tissue. It was hoped that the position and shape of the postocular mark and the shape of the caudal fin, as described and figured by Bleeker, could be verified; however, the postorbital part of the head is badly damaged and no color markings are visible. The caudal fin is mutilated.

Paracirrhites xanthus, new species

Figure 15

Holotype.—USNM 190568, a male specimen, 104.0 mm. in standard length, Takapoto Atoll, Tuamotu Archipelago, southeast side of atoll off village on sea side, depth about 25 feet, spear, J. Randall, Nov. 19, 1956.

Paratypes.—USNM 190569, 94.5 mm. in standard length, same collecting data as holotype; SU 54224, 80.4 mm. in standard length, Moorea, Society Islands, 200 yards west of Tareu Pass, depth 15 feet, spear, J. Randall, May 15, 1957; USNM 190570, 2 specimens, 66.7 and 68.0 mm. in standard length, Takaroa Atoll, Tuamotu Archipelago, north side of pass where enters sea, depth 15 feet, spear, J. Randall, Nov. 5, 1956; BM 1960.10.3.1, 69 mm. in standard length, same data as preceding; USNM 190571, 3 specimens, 51.5 to 65.6 mm. in standard length, Caroline Atoll (10°S., 150°14′W.), anchorage on west side outside reef, depth 20 to 30 feet, spear, J. Randall, Feb. 12, 1956.

Description (data in parentheses are the extremes in counts and measurements for paratypes when differing from holotype).—Dorsal rays X,11; anal rays III,6; pectoral rays ii,5,vii; lateral-line scales 50 (49 to 52) (table 2); 5 rows of large scales between lateral line and

spinous portion of dorsal fin; 12 scales below lateral line to origin of anal fin; gill rakers 4+1+12 (4 or 5+1+12 or 13) (9 specimens).

Each of the following measurements is given as a percentage of the standard length; measurements of paratypes are based on 4 specimens, 94.5, 80.4, 66.7, and 51.5 mm. in standard length: greatest depth of body 38.9 (38.1 to 39.9); width of body at gill opening 16.8 (14.8 to 16.9); head length 37.0 (36.5 to 39.1); snout length 12.0 (10.6 to 13.0); eye diameter 7.2 (7.4 to 9.7); postorbital length of head 20.6 (19.3 to 22.2); bony interorbital space 5.3 (5.1 to 5.4); least depth of caudal peduncle 13.0 (13.2 to 14.2); length of caudal peduncle 14.5 (14.0 to 15.2); snout to origin of dorsal fin 40.1 (38.6 to 40.5); snout to origin of anal fin 66.4 (65.8 to 69.8); snout to origin of pelvic fin 44.2 (43.0 to 47.3); length of dorsal fin base 53.8 (52.0 to 54.0); length of anal fin base 18.0 (18.5 to 18.9); length of pectoral fin 22.1 (22.5 to 24.9); length of pelvic fin 18.5 (20.1 to 22.2); length of pelvic spine 11.3 (11.7 to 11.8); length of first dorsal spine 5.5 (5.8 to 6.3); length of third (longest) dorsal spine 12.1 (12.6 to 14.5); length of tenth dorsal spine 8.6 (8.4 to 8.6); length of first dorsal soft ray 18.5 (18.0 to 19.4); length of last dorsal ray 10.7 (11.2 to 12.0); length of first anal spine 8.4 (8.7 to 9.7); length of second anal spine 12.3 (13.6 to 16.5); length of third anal spine 11.7 (12.8 to 14.9); length of first anal soft ray 17.8 (18.2 to 20.6); length of last anal ray 13.5 (14.7 to 15.6); length of caudal fin 20.1 (20.7 to 24.1).

In addition to those of the family and genus, the following characters apply to this species: interorbital slightly concave with a median band of small scales about one-half total width of bony interorbital space; small scales middorsally on snout extend forward to anterior nostrils; a few small embedded scales on preorbital; 6 straight rows of large scales on cheek; large scales on cheek and opercle with small basal scales; large-scaled areas on cheek and opercle bordered by small scales; interopercle covered with small scales; 10 rows of scales above lateral line on caudal peduncle on one side to lateral line on other; about 12 median predorsal scales; small scales basally on fins; maxillary extending to or beyond a vertical through hind edge of pupil; upper middle part of free margin of preopercle with a few tiny serrations; margin of preopercle rounded with no marked concave indentation; pelvic fin tips reach to or slightly beyond anus, but not to origin of anal fin; first dorsal ray slightly extended; second and third of the lower 7 unbranched pectoral rays the longest; caudal fin truncate; hind flap on anterior nostril with about 9 to 17 cirri (17 on holotype).

Color in alcohol light yellowish brown, a little darker dorsally, some specimens with about 3 broad bars faintly visible on back; a pale-edged, slightly irregular black mark about as long as eye extending diagonally upward from rear center of eye; fins pale yellowish, the posterior part

of the upper and lower edges of the caudal fin with a very narrow black margin; on some specimens a dusky streak on membranes in soft portion of dorsal fin just above basal scales; no spots or bands on snout, maxillary, or interopercle.

Life color of holotype bright yellow, the back brownish yellow, with a narrow black postocular mark edged narrowly in pale yellow extending diagonally upward from hind part of eye; spinous portion of dorsal fin yellow, soft portion yellow on basal two-fifths and hyaline with yellow rays on outer three-fifths; remaining fins hyaline with yellow rays except basal scaled portions which are solid yellow; iris yellow with a ring of red-violet. Close inspection of the yellow of the side of the body reveals alternate lines of bright yellow and yellowish white with a faint bluish cast. The overall effect, as when observed underwater, is of an entirely bright yellow fish with a black mark behind the eye. All paratypes were yellow.

Remarks.—Named *xanthus* in reference to the life color.

Unlike other cirrhitids which are often not seen until they move from part of the reef to another, this bright yellow hawkfish is very conspicuous as it rests on the bottom—usually on a small head of brownish or pinkish *Pocillopora*. Individual fish could be approached closely. When an attempt was made to capture one and it escaped, it would either swim to a nearby coral head or hide within cracks in the coral on which it was encountered.

The species was common at Caroline Atoll, occasional in the Tuamotu Archipelago, and rare in the Society Islands. It was observed only on exposed outer reefs at depths of less than 10 to 80 feet.

Paracirrhites xanthus is closely related to the East Indian *P. amblycephalus* (Bleeker). The rounded caudal fin, shape and position of the postocular mark, and orange-red color attributed to *amblycephalus* by Bleeker constitute the principal differences from *xanthus*. The type of *amblycephalus* is badly damaged, and the differences can no longer be demonstrated (see "Remarks" under *amblycephalus*); thus the distinction of these 2 species draws heavily on Bleeker's figure and description.

Paracirrhites nisus, new species

Figure 16

Holotype.—USNM 190572, a ripe female specimen, 77.0 mm. in standard length, Takapoto Atoll, Tuamotu Archipelago, southeast side of atoll off village on sea side; depth about 25 feet, spear, J. Randall, Nov. 19, 1956.

Paratype.—USNM 190573, a male specimen, 51.5 mm. in standard length, same collecting data as holotype.

DESCRIPTION (data in parentheses are the counts and measurements of the paratype when differing from holotype).—Dorsal rays X,11; anal rays III,6; pectoral rays ii,5,vii; lateral-line scales 48 (49); 5 rows of large scales between lateral line and spinous portion of dorsal fin; 11 scales below lateral line to origin of anal fin; gill rakers 4+1+11.

Each of the following measurements is given as a percentage of the standard length: greatest depth of body 38.3 (36.8); width of body at gill opening 17.0 (15.3); head length 39.4 (39.1); snout length 11.6 (11.2); diameter of eye 8.3 (9.5); postorbital length of head 21.8 (21.5); bony interorbital space 5.5 (5.4); least depth of caudal peduncle 13.6; length of caudal peduncle 14.5 (14.6); snout to origin of dorsal fin 41.7 (42.1); snout to origin of anal fin 67.5 (65.2); snout to origin of pelvic fin 44.2 (45.5); length of dorsal fin base 53.5 (51.5); length of anal fin base 18.2 (18.5); length of pectoral fin 23.7 (24.3); length of pelvic fin 20.6 (20.4); length of pelvic spine 12.9 (13.6); length of first dorsal spine 7.8 (7.7); length of third and fourth (longest) spines 13.7 (13.8); length of tenth dorsal spine 9.1 (9.7); length of first dorsal soft ray 18.5 (19.4); length of last dorsal ray 11.4 (11.6); length of first anal spine 8.2 (9.7); length of second anal spine 13.0 (15.1); length of third anal spine 11.6 (12.6); length of first anal soft ray 16.3 (19.0); length of last anal ray 13.7 (13.8); length of caudal fin 21.4 (22.4).

In addition to those of the family and genus, the following characters apply to this species: interorbital slightly concave with a median band of small scales about one-half total width of bony interorbital space; small scales middorsally on snout extend forward almost to anterior nostrils; a few small scales on preorbital; 6 straight rows of large scales on cheek; large scales on cheek and opercle with small basal scales; large-scaled areas on cheek and opercle bordered by small scales; interopercle covered with small scales; 10 rows of scales above lateral line on caudal peduncle on one side to lateral line on other; about 11 median predorsal scales; small scales basally on fins; maxillary extending to or beyond a vertical through hind edge of pupil; upper margin of preopercle smooth or with only a few tiny serrations; margin of preopercle rounded, with no marked concave indentation; tips of pelvic fins reaching anus (holotype) or extending beyond anus; first dorsal soft ray only slightly longer than second; third of lower 7 unbranched pectoral rays the longest; caudal fin truncate; hind flap on anterior nostril with 13 cirri (8 on paratype).

Color in alcohol light brown with a pale lengthwise band, containing posterior portion of lateral line, beginning at level of last dorsal spine and ending in middle of caudal fin; pale band broadly bordered with black except anteriorly (and posteriorly on paratype); an elon-

gate black mark extending diagonally upward from middle of posterior edge of eye, this mark bordered with a pale, dark-margined band which continues along ventral edge of eye and ends on preorbital; anterior nostrils enclosed in a dark-rimmed white spot; upper edge of eye black with 2 white spots; a pair of small white spots, edged in dark brown, anteriorly on snout next to upper lip; a few small blackish streaks on maxillary (one on paratype); spinous portion of dorsal fin and outer part of anal fin slightly dusky; remaining fins pale except dark borders of pale band which extend into center of caudal and the posterior branch and base of the last dorsal ray which are black.

Color in life of holotype: back dusky brown, shading on sides and ventrally to alternate bands of yellow and pale grayish blue; a pinkish white horizontal band on posterior half of body broadly bordered with black except anteriorly, these black borders extending on to middle of caudal fin; an elongate irregular black mark extending diagonally upward from hind edge of eye, this mark narrowly bordered by bright yellow, a trace of red, a narrow black, and finally a narrow bright blue line; multicolored lower border of black mark extends along lower edge of eye almost to upper lip; small blotches of yellow, bordered narrowly with red, black, and bright blue lines on maxillary, tip of snout, anterior nostrils, and dorsal part of eye; spinous portion of dorsal fin dull orange-yellow with a yellow line in outer part of fin; soft portion of dorsal fin hyaline with orange-yellow rays except rear base and posterior ray which are black, this black continuous with upper black border of pinkish white band on body; anal and pelvic fins yellow; caudal fin posterior to pinkish white, black-bordered marking hyaline with orange-yellow rays; pectoral fins orange-yellow; cheeks and opercle dull yellow; lips and chin reddish.

Remarks.—Named *nisus* from the Greek *Nisos*, a fabled king said to have been changed into a hawk.

A juvenile was observed underwater at the locality on the outer reef of Takapoto where the only 2 specimens were collected. It was about 25 mm. long and was colored like the larger fish. A single adult was sighted outside the barrier reef at the atoll of Takaroa in the Tuamotu Archipelago at a depth of 45 feet.

Paracirrhites bicolor, new species

Figure 17

Holotype.—USNM 190574, a ripe female specimen, 73.5 mm. in standard length, Caroline Atoll (10° S., 150° 14′ W.), outer reef, west side of atoll at anchorage, depth about 15 feet, spear, J. Randall, Feb. 12, 1956.

Paratype.—USNM 190575, a male specimen, 60.5 mm. in standard length, same collecting data as holotype.

DESCRIPTION (data in parentheses are the counts and measurements of the paratype when differing from holotype).—Dorsal rays X,11; anal rays III,6; pectoral rays ii,5,vii; lateral-line scales 48 (50 on one side, 52 on other); 5 rows of large scales between lateral line and spinous portion of dorsal fin; 12 scales below lateral line to origin of anal fin; gill rakers 4+1+12 (5+1+13).

Each of the following measurements is given as a percentage of the standard length: greatest depth of body 38.1 (40.2); width of body at gill opening 17.4 (16.2); head length 37.7 (37.8); snout length 11.1 (10.2); eye diameter 8.6 (8.8); postorbital length of head 20.5 (20.7); bony interorbital space 5.6 (5.8); least depth of caudal peduncle 12.9 (13.2); length of caudal peduncle 15.1 (14.9); snout to origin of dorsal fin 40.7 (40.5); snout to origin of anal fin 69.5 (70.2); snout to origin of pelvic fin 45.7 (42.0); length of dorsal fin base 53.5 (51.3); length of anal fin base 18.1 (19.0); length of pectoral fin 24.1 (23.1); length of pelvic fin 20.4 (20.6); length of pelvic spine 12.9 (13.5); length of first dorsal spine 6.8 (7.1); length of third (longest) dorsal spine 14.7 (14.5); length of tenth dorsal spine 8.8 (7.1); length of first dorsal soft ray 17.9 (18.1); length of last dorsal ray 11.0 (11.2); length of first anal spine 8.9 (8.7); length of second anal spine 15.2 (14.7); length of third anal spine 12.9 (12.4); length of first anal soft ray 18.8 (18.3); length of last anal ray 13.3 (14.0); length of caudal fin 21.1 (21.0).

In addition to those of the family and genus, the following characters apply to this species: interorbital slightly concave with a median band of small scales about one-half to two-thirds the total width of bony interorbital space; small scales middorsally on snout extend forward to anterior nostrils; preorbital scaled, especially posteriorly; a small patch of scales on side of snout just below and slightly anterior to anterior nostril; 6 straight rows of large scales on cheek; large scales on cheek and opercle with small basal scales; large-scaled areas on cheek and opercle bordered by small scales; interopercle covered with small scales; 10 to 11 rows of scales above lateral line on caudal peduncle on one side to lateral line on other; about 11 median predorsal scales; small scales basally on fins; maxillary reaching past center of eye but not posterior to a vertical at hind edge of pupil; about upper two-fifths of free margin of preopercle finely serrate; preopercular margin rounded with no concave indentation; pelvic fin tips reaching anus; first dorsal soft ray very slightly longer than second; third of the lower 7 unbranched pectoral rays the longest; caudal fin truncate; hind flap on anterior nostril with 10 cirri.

Color in alcohol dark brown, the caudal peduncle and ventral part of abdomen and body just above base of anal fin pale yellowish (brown

body color of paratype extends to base of anal fin); a black mark nearly as long as eye and about equal in width to the diameter of pupil extending diagonally upward from midposterior edge of eye, this mark bordered with a bicolored band which is pale inwardly and black outwardly, the band extending along lower edge of eye half way to upper lip; anterior nostrils in a dark-edged pale blotch, the flap pale, the cirri dark brown; an elongate pale spot on maxillary; 2 small pale spots anteriorly on snout next to upper lip; upper edge of eye black; spinous portion of dorsal fin brownish, soft portion dark brown on basal scaled part, rays light yellowish, membranes with a pale yellowish band just above scaled basal part, this separated by a dark line (better seen on paratype) from upper hyaline part of fin membranes; caudal fin pale yellowish like caudal peduncle except for very narrow black margins on upper and lower edges of fin; anal fin brownish, almost as dark as spinous portion of dorsal fin; pectoral fins brown basally and in middle of fin, becoming pale yellowish outwardly; pelvic fins brownish with pale yellowish rays, the lateral edge of fins dark brown. Life colors not recorded.

Remarks.—Named *bicolor* in reference to the contrasting dark anterior and pale posterior parts of the body.

Of the 5 species of *Paracirrhites* with postocular marks, which might be termed the *arcatus* complex, *bicolor* seems most closely related to *nisus*.

Genus *Cirrhitops* Smith

Cirrhitops Smith, 1951, Ann. Mag. Nat. Hist., ser. 12, vol. 4, pp. 627, 637. (Type species, *Cirrhites fasciatus* Bennett, by original designation.)

Diagnosis.—Uppermost 2 and lower 6 pectoral rays unbranched; dorsal soft rays 14 (rarely 15); a few small teeth anteriorly on palatines; upper three-fifths of free margin of preopercle finely serrate, lower two-fifths smooth; preorbital without a free hind edge; interorbital not scaled; 5 rows of large scales on cheek; 4 rows of large scales above lateral line in middle of body; depth of body about 2.8 in standard length; snout length about 3.5 in head length; snout not pointed, profile from interorbital to upper lip convex; a tuft of cirri from membrane near tip of each dorsal spine; membranes between spinous portion of dorsal fin moderately incised, the one between fifth and sixth spines notched about one-third of spine lengths; longest dorsal spine about 2.3 in depth of body; first dorsal soft ray not produced; longest pectoral ray (tenth) reaching to or slightly beyond origin of anal fin, this ray about 1.5 times longer than longest branched ray of fin; uppermost simple pectoral ray (ninth) intermediate in length to lowermost branched ray (eighth) and longest unbranched ray; pelvic fins reach anus; caudal fin truncate.

Key to the Species of *Cirrhitops*

1a. Body with 5 vertical dark bars, the most posterior one the darkest; no dark lines on lips (Hawaii, Japan, Madagascar, and Mauritius) . . . **fasciatus**

1b. Body without vertical bars, having instead 4 lengthwise rows of pale spots (the upper 2 rows being more evident because of darker upper half of body) and a pale caudal peduncle containing a large black spot; lips crossed with brown lines (Phoenix Islands and Tuamotu Archipelago) . . . **hubbardi**

Cirrhitops fasciatus (Bennett)

FIGURE 18

Cirrhites fasciatus Bennett, 1828, Zool. Journ., vol. 4, p. 39 (type locality, Hawaiian Islands).

Cirrhites cinctus Günther, 1860, Catalogue . . . fishes . . . British Museum, vol. 2, p. 73 (type locality, Hawaiian Islands, Madagascar, Mauritius).

DIAGNOSIS.—Dorsal rays X,14 (one with 15); anal rays III,6; pectoral rays ii,6,vi; lateral-line scales 48 to 53; 4 large scales above lateral line in middle of body; 11 or 12 large scales below lateral line to origin of anal fin; gill rakers 4+1+12 (10 specimens, Hawaii).

Color in alcohol: alternate broad dark-brown and narrow pale bars on the body, the pale bars divided ventrally by narrow dark bars; broad dark bars vertical anteriorly, slanted posteriorly; last dark bar (fifth) on caudal peduncle the darkest; a dark spot on opercle; head and chest with a reticulation of dark lines.

Life color from kodachromes of 3 Hawaiian specimens (60 to 75 mm. standard length) taken by the author: body with 5 broad red or reddish-brown bars (the last across caudal peduncle the darkest) which narrow and angle slightly posteriorly as they pass downward; white interspaces between these bars bisected ventrally by narrow brownish-red bars; head and chest with orange-red to reddish-brown vermiculations on white; an indistinct brown spot on opercle at level of lower edge of eye formed by a coalescing and darkening of head markings; dorsal fin mottled red, penetrated basally by continuations of white spaces between dark bars on body; caudal peduncle and fin posterior to dark bar light red; anal and paired fins pale (pinkish in darker specimens).

REMARKS.—USNM specimens from the Hawaiian Islands and Yokohama, Japan, were examined. Günther (1860) recorded the species (as *cinctus*) from Madagascar and Mauritius, thus giving the species a unique distribution at the present time. Specimens may eventually be taken at intervening localities between Japan and the western Indian Ocean, such as the Philippines and East Indies. Fowler (1927) recorded a specimen which he identified as *cinctus* from Christmas Island, Line Islands; however, this fish proved to be *Cirrhitichthys oxycephalus* Bleeker.

Cirrhitops hubbardi (Schultz)

FIGURE 19

Amblycirrhitus hubbardi Schultz, 1943, U.S. Nat. Mus. Bull. 180, p. 132, fig. 12 (type locality, Enderbury Island, Phoenix Islands).

DIAGNOSIS.—Dorsal rays X,14; anal rays III,6; pectoral rays ii,6,vi; lateral-line scales 52; 4 rows of large scales above lateral line in middle of body; 11 or 12 scales below lateral line to origin of anal fin; gill rakers 4 to 5+1+12 or 13 (4 specimens).

Color in alcohol brown shading to light tan on lower half of body, with 4 rows of white spots on the side and a large jet-black spot on caudal peduncle; a blackish area on opercle composed of several irregular black markings; vertical dark lines on lips; irregular small dark spots and lines on head and chest.

Color from a 35 mm. kodachrome transparency taken of a specimen 70 mm. in standard length from Makatea in the Tuamotus by the author: body brown on back, shading on sides to brownish orange, and becoming white on abdomen; 4 lengthwise rows of white spots on body; caudal peduncle light orange with a large black spot; head and chest with irregular rows of small spots and short lines, those on dorsal part of head brown and those ventral to eye bright red; a group of spots and irregular short lines on opercle at level of lower edge of eye darker than other head markings; dorsal fin mottled with red; caudal fin light red, abruptly light orange at base; anal fin pale; paired fins pinkish.

REMARKS.—Smith (1951, p. 637) placed *hubbardi* in the synonymy of *cinctus* (=*fasciatus*), stating that it is almost certainly the juvenile of *fasciatus*. Although these 2 species are obviously very closely related, they do appear distinct. The color pattern of *hubbardi* is definitely not the juvenile color of *fasciatus*. W. A. Gosline kindly checked specimens of *fasciatus* in the collection of the University of Hawaii down to 26 mm. in standard length and reported them looking "pretty much like the larger ones."

C. hubbardi is presently known only from the 3 small type specimens from the reef of Enderbury Island, the single specimen from the Tuamotu Archipelago, and a specimen in the Academy of Natural Sciences of Philadelphia (No. 84311), 79 mm. in standard length, with no locality but labelled "probably Oceania". The specimen is cataloged as a type; however, Henry W. Fowler informed the author that the name he proposed has not been published.

C. hubbardi and *C. fasciatus*, as mentioned, are closely related. They may represent allopatric species, the former being restricted to Oceania except Hawaii. Further collecting is necessary to verify this.

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The 70-mm. Tuamotu specimen was collected with rotenone on an exposed reef in less than 15 feet of water near the phosphate loading dock of Makatea. *Amblycirrhitus bimacula*, *Isocirrhitus sexfasciatus*, *Cirrhitus pinnulatus*, *Paracirrhites arcatus*, and *P. hemistictus* were collected at the same station.

The holotype (USNM 115750), 35 mm. in standard length, was examined. The 47-mm. paratype is now in the Museum of Comparative Zoology at Harvard University (No. 37288).

Isocirrhitus, new genus

Diagnosis.—Uppermost and lower 5 pectoral rays unbranched; dorsal soft rays 11; palatine teeth absent; upper third of free margin of preopercle finely serrate, lower two-thirds smooth; suprascapular margin smooth (serrate on other genera except for some species of *Cirrhitus*, *Paracirrhites* and *Amblycirrhitus*); preorbital without a free hind margin and bearing only a few scales posteriorly; interorbital scaled; 4 or 5 rows of large scales on cheek; 4 rows of large scales above lateral line in middle of body; depth of body 2.7 in standard length; snout length about 3.7 in head length; snout not pointed, the profile from interorbital to upper lip convex; a tuft of cirri from membrane near tip of each dorsal spine; membranes of dorsal fin moderately incised; longest dorsal spine 3.5 to 4 in body depth; first soft ray of dorsal fin not produced into a filament; pectoral fins short, their length about 1.4 in head length; longest unbranched pectoral ray about 1.25 times longer than longest branched pectoral ray; pelvic fins do not reach anus; caudal fin truncate.

Type species.—*Cirrhitoidea sexfasciata* Schultz. Monotypic.

Remarks.—Although evidently related to *Cirrhitops*, *Amblycirrhitus* and *Cirrhitichthys*, *Isocirrhitus* is distinct from all these genera in its lack of palatine teeth and the shortness of its dorsal spines. Other characters, such as degree of serration of preopercle, presence or absence of a free margin on preorbital, number of dorsal rays and shape of snout, are variously shared among the four genera. *Isocirrhitus* cannot be differentiated from *Paracirrhites* on the basis of absence of palatine teeth and short dorsal spines; however, it is separable from this genus by having 4 instead of 5 rows of scales above the lateral line, a tuft of cirri instead of a single cirrus from the membrane near the tip of each dorsal spine, and the lower 5 (instead of 7) pectoral rays unbranched. Its unbranched pectoral rays are not as long relative to the branched rays as those of *Cirrhitops*, *Amblycirrhitus* and *Cirrhitichthys* but longer than *Paracirrhites*.

Isocirrhitus sexfasciatus (Schultz)

FIGURE 20

Paracirrhites cinctus Harry, 1953 (non Günther), Atoll Res. Bull. 18, p. 88, (Raroia, Tuamotu Archipelago).

Cirrhitoidea sexfasciata Schultz, *in* Schultz and collaborators, 1960, U.S. Nat. Mus. Bull. 202, vol. 2, pp. 255, 257, fig. 106 (type locality, Bikini Atoll, Marshall Islands).

DIAGNOSIS.—Dorsal rays X,11; anal rays III,6; pectoral rays i,8,v; lateral-line scales 44 or 45; 4 rows of large scales above lateral line in middle of body; 9 scales below lateral line to origin of anal fin; gill rakers 4 or 5+1+11 (3 specimens, Tuamotu Archipelago).

Color light tan with 7 broad blackish vertical bars, the first on the nape and the last at the base of the caudal fin. A drab species for a cirrhitid, its life color is not much different from that in alcohol. Harry (1953) gave a detailed color description. Further characters are given in the generic diagnosis.

REMARKS.—Three specimens, 61 to 70 mm. in standard length, were collected by the author at Makatea in the Tuamotu Archipelago at the same collecting station as the previous species. Known only from the Marshall Islands and the Tuamotu Archipelago, but continued collecting will probably reveal its presence elsewhere in the Indo-Pacific.

The holotype (USNM 141980) is 77.5 mm. in standard length.

Genus *Amblycirrhitus* Gill

Amblycirrhitus Gill, 1862, Proc. Acad. Nat. Sci. Philadelphia, p. 105. (Type species, *Cirrhites fasciatus* Cuvier, by original designation and monotypy = *Amblycirrhitus indicus* Fowler.)

Cirrhitoidea Jenkins, 1903, Bull. U.S. Fish Comm., vol. 22 (1902), p. 489. (Type species, *Cirrhitoidea bimacula* Jenkins, by monotypy.)

Pseudocirrhites Mowbray, *in* Breder, 1927, Bull. Bingham Oceanogr. Coll., vol. 1, p. 48. (Type species, *Pseudocirrhites pinos* Mowbray, by monotypy.)

DIAGNOSIS.—Upper 1 or 2 and lower 5 (rarely 6) pectoral rays unbranched; dorsal soft rays 11 or 12; palatine teeth present; upper margin of preopercle finely serrate; preorbital without a free hind margin; interorbital scaled; 4 or 5 rows of large scales on cheek; 3 or 4 rows of large scales above lateral line in middle of body; depth of body 2.3 to 3.2 in standard length; snout length 3.1 to 3.8 in head length; snout pointed, profile from interorbital to upper lip nearly straight; a tuft of cirri from membrane near tip of each dorsal spine; membranes of dorsal fin moderately to deeply incised, the one between fifth and sixth dorsal spines notched more than three-tenths length of spines; longest dorsal spine 2.3 to 3.2 in body depth; first dorsal soft ray not produced into a filament; pectoral fins moderately

long, extending to anus and usually to origin of anal fin; lower unbranched rays of pectoral fin markedly longer than upper branched rays, the uppermost unbranched ray usually the longest; caudal fin truncate.

Key to the Species of *Amblycirrhitus*

1a. Lateral-line scales 38 to 45; pectoral fins reach or extend beyond origin of anal fin; dorsal soft rays 11 or 12; ocellated black spot on opercle present or absent.

2a. Dorsal soft rays 11; upper ⅓ to ¾ of preopercular margin serrate; small pale spots on head, anteriorly on body, and on dorsal fin.

3a. Depth of body 2.3 in standard length; dorsal profile from snout forms an angle of 48° to horizontal; lateral-line scales 45; upper 2 pectoral rays unbranched (based on a single 93 mm. specimen) (India). **indicus**

3b. Depth of body about 2.7 in standard length; dorsal profile from snout forms an angle of about 35° to horizontal; lateral-line scales 41 to 44; upper pectoral ray unbranched (West Indies and Florida). **pinos**

2b. Dorsal soft rays 12; upper ⅜ to ⅔ of preopercular margin serrate; no small pale spots on head, anteriorly on body, or on dorsal fin.

4a. A large dark brown or black ocellated spot on opercle; head not crossed with 3 vertical dark bars; longest dorsal spine about 2.7 in depth of body (Indo-Pacific) . . . . . **bimacula**

4b. No large dark brown or black ocellated spot on opercle; head crossed with 3 vertical dark bars, the first running ventrally from eye, the next 2 on operculum; longest dorsal spine about 2.3 in depth of body (East Indies). . . . . **oxyrhynchos**

1b. Lateral-line scales 48 to 50; pectoral fins do not reach origin of anal fin; dorsal soft rays 11; ocellated black spot on opercle absent (Ryukyu Islands and Formosa) . . . . . **unimacula**

Amblycirrhitus indicus Fowler

FIGURE 21

Cirrhites fasciatus Cuvier, *in* Cuvier and Valenciennes, 1829 (non Bennett), Histoire naturelle des poissons, vol. 3, p. 76, pl. 47 (type locality, Pondichéry, India).

Cirrhitichthys fasciatus Day, 1888, Fishes of India . . . , suppl., p. 788 (Madras); 1889, Fauna of British India, Fishes, vol. 2, p. 145.

Amblycirrhitus indicus Fowler, 1938, Proc. U.S. Nat. Mus., vol. 85, p. 49 (new name for *Cirrhites fasciatus* Cuvier, preoccupied by *C. fasciatus* Bennett, 1828).

DIAGNOSIS.—Dorsal rays X,11; anal rays III,6; pectoral rays ii,7,v; lateral-line scales 45; 4 rows of large scales above lateral line in middle of body (one specimen, Pondichéry).

Depth of body about 2.3 in standard length; dorsal profile from snout forms an angle of 48° with a line from tip of snout to center of caudal fin; longest pectoral rays (tenth and eleventh) nearly reach a vertical through origin of anal fin (from Cuvier's illustration; rays

broken on specimen); pelvic fins reach origin of anal fin; snout about 3.5 in head length.

Color light brown with 8 alternately broad and narrow vertical dark bars on body which narrow as they pass ventrally; bar on caudal peduncle and upper part of preceding bar the darkest; small pale spots on snout, nape, and spinous portion of dorsal fin.

Remarks.—The holotype (MNHN 5428 A) is a dried half-specimen varnished and mounted on glass. The color pattern is so remarkably close to the West Indian *pinos* that *indicus* was thought to be this species at first glance. There are adequate morphological characters, however, to separate the two. The holotype of *indicus* measures 93 mm. in standard length (which is considerably larger than the largest of many individuals of *pinos* that have been observed). Other measurements from the type are: depth 40.5 mm.; head 32 mm.; snout 9.3 mm.; eye 7 mm.; depth of caudal peduncle 13.5 mm.; caudal fin 13.5 mm.; pelvic fins 24.2 mm.; first dorsal spine 4.7 mm.; second dorsal spine 8.5 mm.; third dorsal spine 12.6 mm.; ninth dorsal spine 10.8 mm.; tenth dorsal spine 14 mm.; first dorsal soft ray 19 mm.; last dorsal soft ray 10.7 mm.; first anal spine 12 mm.; second anal spine 22 mm.; third anal spine 17 mm.; first anal soft ray broken; last anal ray 12 mm.

The type shows some notable differences from Cuvier's plate. The origin of the dorsal fin is not anterior to the hind edge of the preopercle as illustrated, but is in line with a vertical at the hind edge; the caudal fin is longer than illustrated; instead of a single cirrus from the membrane at the tip of each dorsal spine there is a tuft of cirri (congealed to a single unit by the varnish); the preorbital has no free hind edge; there are 27 small serrations on the free margin of the preopercle.

Known only from India from the type and two small specimens reported by Day.

Amblycirrhitus pinos (Mowbray)

Figure 22

Pseudocirrhites pinos Mowbray, *in* Breder, 1927, Bull. Bingham Oceanogr. Coll., vol. 1, p. 48, fig. 23 (type locality, Isle of Pines).

Pseudocirrhites pinos Tee-Van, 1940, Zoologica, vol. 25, p. 61, text fig. 3 (Isle of Pines and Saba Bank).

Diagnosis.—Dorsal rays X,11; anal rays III,6; pectoral rays i,8,v; lateral-line scales 41 to 44; 4 rows of large scales between lateral line and spinous portion of dorsal fin (3 rows beneath soft portion of fin); 9 scales below lateral line to origin of anal fin; gill rakers 4 or 5+1+8 to 10 (18 specimens, West Indies and Florida).

Depth of body of adults about 2.7 in standard length; dorsal profile from snout forms an angle of about 35° with a line from tip of snout to center of caudal fin; longest pectoral rays reaching a vertical through base of second to third anal spines; pelvic fins not reaching origin of anal fin; snout of adults about 4 to 4.5 in head length.

Color in alcohol light tan with alternate broad and narrow dark bars on body, the one across caudal peduncle and upper part of previous one at base of soft portion of dorsal fin jet black; small pale spots on head, nape, chest, pectoral base, and spinous portion of dorsal fin.

Color in life: body with 5 broad dark bars, the first 3 yellowish brown, the upper rounded part of the fourth black and the fifth across the caudal peduncle entirely black; white interspaces between first 4 broad bars bisected by narrow yellowish brown bars; head, anterior part of body, and dorsal fin with bright red-orange dots; scaled portion of dorsal fin colored like body, unscaled portion hyaline; red-orange spots on soft portion of fin located on fin rays (fade in preservative); caudal fin pink, becoming white basally; anal and pelvic fins hyaline with light brownish rays; pectoral fins pale pink; iris yellowish.

Remarks.—Known previously from the Isle of Pines just south of western Cuba and the Saba Bank in the Lesser Antilles. The Saba Bank specimen is a 26-mm. juvenile collected by William Beebe at a depth of 25 fathoms. In recent years the species has been collected by the author in the Virgin Islands, Puerto Rico, Curaçao, Haiti, and the Bahamas, and by Walter A. Starck II and the author at Alligator Reef in the Florida Keys. Starck collected a 23-mm. specimen from Banco Chinchorro, off Yucatan. Collecting depths have been 8 to 120 feet. These specimens are deposited at the Marine Laboratory of the University of Miami and at the University of Puerto Rico, Mayaguez, Puerto Rico. Largest specimen, 68 mm. in standard length, from the Florida Keys.

The holotype (BOC 382) is 54.5 mm. in standard length.

Two specimens collected in August 1955 measure 24.0 and 24.7 mm. in standard length and appear to be transforming from the late postlarval stage to the juvenile form. Although pale, the barred color pattern may be faintly seen, the caudal peduncle and upper part of preceding bar being the darkest. These specimens differ from larger *pinos* in being relatively more elongate (depth 7.5 and 8.1 mm., respectively), in having a forked caudal fin (caudal indentation 3 and 2.5 mm., respectively), and in having the eye nearer the center of the head (separated by more than 0.5 mm. from upper profile of head). A 25-mm. juvenile collected in November 1959 has the typical adult color pattern, a slightly forked tail, a body depth of 9 mm., and the

upper edge of the eye at the profile of the head. A 24-mm. juvenile collected in July 1959 is adultlike in its color and has slightly emarginate caudal fin, body depth of 9.5 mm., and eye which juts slightly above the profile of the head. These 4 specimens were collected in the Bahamas in connection with the ichthyological program of Charles C. G. Chaplin and James E. Böhlke and are deposited in the Academy of Natural Sciences of Philadelphia under Nos. 93637 to 93640.

Amblycirrhitus bimacula (Jenkins)

FIGURE 23

Cirrhitoidea bimacula Jenkins, 1903, Bull. U.S. Fish Comm., vol. 22 (1902), p. 459, fig. 36 (type locality, Honolulu).

DIAGNOSIS.—Dorsal rays X,12; anal rays III,6; pectoral rays i,8,v; lateral-line scales 40 to 42 (only one with 42); 3 large scales above lateral line in middle of body; 9 scales below lateral line to origin of anal fin; gill rakers 3 to 5+1+10 or 11 (12 specimens, Marshall Islands, Johnston Island, and Tuamotu Archipelago).

Longest pectoral ray reaching a vertical through base of second anal spine; depth of body of adults 2.8 to 3 in standard length; origin of dorsal fin slightly anterior to a vertical at hind edge of opercular membrane.

Color in preservative light brown with about 10 slightly irregular brown bars (some of which break into spots on occasional specimens); an ocellated black spot almost as large as eye on opercle slightly below level of eye and another on back and scaled portion of soft dorsal centered at base of ninth soft ray of fin; upper portion of 3 body bars usually cojoin to enclose that portion of ocellated spot on body and base of soft dorsal; head mottled with brown, some specimens with 1 or 2 diagonal brown bands on cheek; tips of spinous dorsal membranes not blackish.

REMARKS.—Jenkins was mistaken in stating that *bimacula* has no palatine teeth. The holotype (USNM 50702), 41 mm. in standard length, was examined, and teeth were found on the palatines.

A. bimacula has an extensive range, east Africa (Smith, 1951) to Hawaii; however, records of the species are not numerous. Intermediate localities from which it has been taken are: Aldabra (Smith, 1955, name only); Comore Islands (Fourmanoir, 1954, name only); Saleyer, East Indies (Weber, 1913; de Beaufort, 1940); Rose Island, Samoa Islands (Schultz, 1943); Raroia, Tuamotu Archipelago (Harry, 1953); and the Marshall Islands (Schultz, *in* Schultz and collaborators, 1960). A specimen, 54.5 mm. in standard length, was recently collected in the Seychelles by James Morrow and deposited in the Bingham Oceanographic Laboratory at Yale University. The author collected one, 51.5 mm. in standard length, at Makatea in the

Tuamotu Archipelago. A 43-mm. specimen from Tahiti and 3 specimens from 43 to 51 mm. in standard length from the Solomon Islands were sent on loan from the British Museum by A. C. Wheeler. Largest specimen examined, 67 mm. in standard length, from Kwajalein.

Amblycirrhitus oxyrhynchos (Bleeker)

FIGURE 24

Cirrhitichthys oxyrhynchos Bleeker, 1858, Natuurk. Tijdschr. Nederlandsch-Indië, vol. 15, p. 205 (type locality, Goram Islands, East Indies).

Cirrhitichthys oxyrhynchus Bleeker, 1876–77, Atlas ichthyologique . . . vol. 8, p. 146, pl. 303, fig. 4.

DIAGNOSIS.—Dorsal rays X,12; anal rays III,6; pectoral rays i,8,v; lateral-line scales 40; 3 rows of large scales above lateral line in middle of body; 10 scales below lateral line to origin of anal fin. Longest pectoral rays reaching a vertical through base of third anal soft ray; depth of body 3.1 in standard length; origin of dorsal fin over hind margin of opercle; lower jaw projects slightly anterior to upper; longest dorsal spine (sixth) 2.3 in depth of body (2.6 to 3.2 for other species of *Amblycirrhitus*).

Color of body and fins rose with 8 near-vertical brown bars or elongate spots on body and 3 bars on head; a round dark brown spot on back at rear base of soft portion of dorsal fin (after Bleeker's description and figure).

REMARKS.—M. Boeseman kindly examined the holotype (No. 5842) at the Rijksmuseum van Natuurlijke Historie at Leiden. He verified Bleeker's fin-ray counts, length shown for the pectoral fin, and slight jutting of the lower jaw. The following measurements were made: standard length 43 mm.; total length 52 mm.; body depth 13.8 mm.; snout length 4.2 mm.; longest dorsal spine 6 mm. The margin of the preopercle above the level of the center of the eye bears 15 small serrations. Color markings are no longer visible on the specimen.

De Beaufort (1940, p. 10) erroneously placed *oxyrhynchos* in the synonymy of *Cirrhitichthys oxycephalus* Bleeker.

Fowler (1959, p. 288) recorded *oxyrhynchos* from Fiji without seeing a specimen. He based his record on an entry in the catalog of the Museum Godeffroy. Otherwise known only from the type locality, Goram Islands.

Amblycirrhitus unimacula (Kamohara)

FIGURE 25

Cirrhitoidea unimacula Kamohara, 1957, Rep. Usa Mar. Biol. Sta., vol. 4, pp. 2, 30, fig. 19 (type locality, Sōmachi, Ryukyu Islands).

DIAGNOSIS.—Dorsal rays X,11; anal rays III,6; pectoral rays i,8,v; lateral-line scales 48; 4 rows of large scales above lateral line

in middle of body; 12 scales below lateral line to origin of anal fin (1 specimen, Formosa; gills and viscera have been removed).

Longest pectoral rays extending slightly posterior to a vertical at anus; depth about 3.2 in standard length; origin of dorsal fin over hind edge of opercular membrane.

Color in alcohol light tan with about 10 vertical dark brown bars of unequal width, most of which narrow as they pass downward on the body; an ocellated black spot as large as eye on back above lateral line extending on to posterior half of soft portion of dorsal fin; several brown bands and blotches on head, but no large dark spot on opercle; membrane behind tip of each dorsal spine blackish, cirri pale.

Remarks.—In the description of *unimacula*, Kamohara stated that palatine teeth were absent. Because other species of *Amblycirrhitus* have teeth on the palatines, the author wrote Kamohara requesting that he re-examine the type for such teeth. He reported that palatine teeth were present but small and difficult to see.

After Kamohara was queried, the second known specimen of this species was cataloged at the U.S. National Museum. It was collected by R. E. Kuntz in shallow water on the west coast of the island of Lan Yu, about 40 miles east of southern Formosa. The fish measures 63 mm. in standard length. The holotype (No. 6387, Biological Laboratory, Kochi University, Japan) is 85 mm. in standard length. It was taken in a tide pool at Sōmachi, Ryukyu Islands. The Lan Yu fish differs from the type as described in having 48 instead of 50 lateral-line scales, in the lower jaw not projecting anterior to the upper, and in the pelvic fins just reaching the anus instead of falling short of it.

Genus *Cirrhitichthys* Bleeker

Cirrhitichthys Bleeker, 1856, Natuurk. Tijdschr. Nederlandsch-Indië, vol. 10, p. 474. (Type species, *Cirrhites graphidopterus* Bleeker, probably by monotypy = *Cirrhites aprinus* Cuvier.) (Bleeker, 1856, reference not seen; pagination from Gill, 1862, and Bleeker, 1876–77.)

Cirrhitopsis Gill, 1862, Proc. Acad. Nat. Sci. Philadelphia, pp. 105, 109. (Type species, *Cirrhites aureus* Temminck and Schlegel, by monotypy; proposed as a subgenus.)

Acanthocirrhitus Fowler, 1938, Proc. U. S. Nat. Mus., vol. 85, p. 50. (Type species, *Cirrhites oxycephalus* Bleeker, by original designation and monotypy.)

Diagnosis.—Upper 1 or 2 and lower 6 or 7 pectoral rays unbranched; dorsal soft rays 12 or 13; palatine teeth present; upper margin of preopercle coarsely serrate (the serrations usually spinous), lower margin smooth or serrate; preorbital with hind margin free for about one-fourth to three-fourths the distance from lower edge to eye (this free edge may bear small spinelike serrations in some species);

interorbital not scaled posteriorly; 3½ to 4 rows of large scales on cheek; 3 or 4 rows of large scales above lateral line in middle of body; depth of body 2.2 to 3 in standard length; snout length 2.9 to 3.8 in head length; snout pointed, profile from interorbital to upper lip nearly straight; a tuft of cirri from membrane near tip of each dorsal spine; membranes of dorsal fin moderately to deeply incised, the one between fifth and sixth dorsal spines notched more than three-tenths the length of spines; longest dorsal spine (usually fifth but may be fourth or sixth) about 1.5 to 2.6 in depth of body; first dorsal soft ray produced into a filament (with exception of *falco* and possibly *guichenoti*); pectoral fins moderately long, extending nearly to or beyond a vertical at origin of anal fin; lower unbranched pectoral rays markedly longer than branched rays (except uppermost of the lower unbranched rays of those specimens with 7 such rays); pelvic fin tips reach or extend slightly posterior to anus (except for *bleekeri* and Red Sea *oxycephalus*); caudal fin emarginate to truncate.

Key to the Species of *Cirrhitichthys*

1a. Lateral-line scales 40 to 47; 3 rows of large scales above lateral line in middle of body; dorsal soft rays 12 (rarely 13); anal soft rays 6 (rarely 7); snout length 3.2 to 3.8 in head length.

2a. Longest dorsal spine 1.7 to 2.2 in body depth; depth 2.4 to 3 in standard length; lower 6 pectoral rays unbranched.

3a. Depth 2.4 to 2.7 in standard length; bony interorbital space not narrow, its width in adults about 1.7 in diameter of eye; free hind edge of preorbital usually with one to a few small spines; spinous serrations on preopercle 17 to 22 (45 mm. standard length or greater); 6 dark bars on body (faded in some specimens), with a dark spot on lateral line on pale interspaces (East Indies and Philippines) . . **aprinus**

3b. Depth 2.7 to 3 in standard length; bony interorbital space narrow, its width in adults about 2 in diameter of eye; free hind edge of preorbital without spines (except rarely on *serratus*); spinous serrations on preopercle less than 20; no solid dark bars on body (bars, if present, comprised of spots, blotches, or dark-edged scales).

4a. Dorsal profile of head, excluding eye, with a marked indentation just above eye; orangish red bars on body in life, the first 2 usually persisting in preservative as zigzag dark lines following scale rows (probably Mariana Islands) . . . . . **serratus,** new species

4b. Dorsal profile of head, excluding eye, a slightly convex curve, without an indentation; color pattern of subquadrate dark blotches in 3 or 4 rows on body.

5a. Hind edge of maxillary falling slightly forward of a vertical at front edge of eye; fourth dorsal spine the longest; first dorsal soft ray not decidedly longer than more posterior rays (at least in sizes up to 42 mm. standard length); a group of 20 or more small dark brown spots forming a broad bar on nape and opercle, centered on origin of dorsal fin, and a second less conspicuous bar of spots centered on sixth to seventh dorsal spines (these groups of dark spots superimposed on rows of dark blotches) (Philippines) . . . . . **falco,** new species

5b. Hind edge of maxillary reaches or extends posterior to a vertical at front edge of eye; fifth dorsal spine the longest; first dorsal soft ray decidedly longer than more posterior rays (35 mm. standard length or greater); no groups of 20 or more dark spots forming bars anteriorly on body (Indo-Pacific and tropical eastern Pacific) . . . . . **oxycephalus**

2b. Longest dorsal spine 2.2 to 2.6 in body depth; depth 2.2 to 2.5 in standard length; lower 7 (occasionally 6) pectoral rays unbranched.

6a. Pelvic fins reaching anus; color not as in 6b.

7a. Median anterior part of interorbital space and region between nostrils scaled; color in alcohol uniform pale yellowish brown (orange or yellow in life) (Japan and China) . . . . . **aureus**

7b. Median anterior part of interorbital space and region between nostrils not scaled; color dark brown with a pale yellowish caudal fin which is sparsely spotted with blackish and has a broad blackish posterior border (Gulf of Oman and Red Sea) . . . . . **calliurus**

6b. Pelvic fins not reaching anus; color rosy with light longitudinal lines and a large ill-defined dark blotch below soft portion of dorsal fin; a dark spot behind upper edge of preopercle (India) (after Day) . . **bleekeri**

1b. Lateral-line scales 52; 4 rows of scales above lateral line in middle of body; dorsal soft rays 13; anal soft rays 7; snout length about 3 in head length (Réunion Island, Indian Ocean) . . . . . **guichenoti**

Cirrhitichthys aprinus (Cuvier)

FIGURE 26

Cirrhites aprinus Cuvier, *in* Cuvier and Valenciennes, 1829, Histoire naturelle des poissons, vol. 3, p. 76 (type locality, Timor).

Cirrhites graphidopterus Bleeker, 1853, Natuurk. Tijdschr. Nederlandsch-Indië, vol. 4, p. 106 (type locality, Amboina).

Cirrhitichthys aprinus Bleeker, 1876–77, Atlas ichthyologique . . ., vol. 8, p. 146, pl. 303, fig. 1 (East Indies).

Cirrhitichthys aprinus Ramsay and Douglas-Ogilby, 1886, Proc. Linn. Soc. New South Wales, vol. 10, p. 575 (Shark Reef, Port Jackson, Australia).

Cirrhitichthys analis Fowler, 1938, Proc. U.S. Nat. Mus., vol. 85, p. 48, fig. 18 (type locality, Jolo, Philippines).

DIAGNOSIS.—Dorsal rays X,12; anal rays III,6; pectoral rays i,7,vi; lateral-line scales 41 to 43; 3 rows of large scales above lateral line in middle of body; 9 or 10 scales below lateral line to origin of anal fin; gill rakers 4 or 5+1+9 to 11 (9 specimens, Philippines and East Indies).

Depth of body 2.4 to 2.7 in standard length; snout 3.5 to 3.8 in head length; longest dorsal spine 1.8 to 2 in depth; bony interorbital space about 1.7 in eye of adults; median anterior part of interorbital space and region between nostrils scaled; profile of head, excluding eye, with a marked indentation above eye; serrations on preopercle 17 to 22 (at standard lengths greater than about 45 mm.); preorbital unscaled, its free hind edge usually with one to a few spines; maxillary ending beneath anterior fourth of eye; first dorsal soft

ray prolonged; tips of pelvic fins reaching beyond anus; caudal fin slightly emarginate.

Color in alcohol light brown with 6 dark vertical bars (faded on some specimens), the middle 4 of which extend into base of dorsal fin; a dark spot on lateral line on pale interspace between the first 4 bars; a group of small dark brown spots in a diamond shape on posterior part of interorbital space and a comparable area of nape; scattered small spots anteriorly on interorbital and dorsally on snout may be present; a group of larger dark brown spots on opercle and one just above upper end of gill opening; 3 dark streaks on head, running ventrally from eye; a small blackish blotch anteriorly on dorsal fin and a larger one on the outer posterior part of spinous portion of fin; soft portion of fin spotted with black; remaining fins pale. Life color given by Cuvier and Bleeker as red with vertical blackish bars.

Remarks.—The holotype of *aprinus* (MNHN 2774) is 61 mm. in standard length and 75 mm. in total length. Other measurements and counts of this specimen are: depth 23.5 mm.; head 20.5 mm.; snout 5.5 mm.; eye 5.5 mm.; bony interorbital 3.2 mm.; first dorsal spine 5.5 mm.; longest dorsal spine 10.2 mm.; first dorsal soft ray broken; pectoral fin 20.5 mm.; lateral-line scales 43; 3 scales above lateral line in middle of body, 4 to origin of dorsal fin, 10 to origin of anal fin; a few small scales anteriorly on interorbital; gill rakers 4+1+11; serrations on preopercle 18.

The U.S. National Museum has 8 Philippine specimens (Nos. 150609–13), 40 to 71 mm. in standard length, and the holotype of *Cirrhitichthys analis* Fowler (No. 98901). The American Museum of Natural History has a 71-mm. specimen from Bali (No. 15011). The types of *graphidopterus* Bleeker cannot be sorted from a series of 10 specimens (No. 6810) in the Rijksmuseum van Natuurlijke Historie at Leiden.

Some recent authors have erroneously used the name *aprinus* for the species *oxycephalus* Bleeker.

Cirrhitichthys serratus, new species

Figure 27

Holotype.—USNM 195943, a female specimen, 62.7 mm. in standard length, Pearl Harbor, Oahu, Hawaiian Islands, S. Tinker, April 1950, from a drydock hauled one year before from Guam, Mariana Islands.

Paratypes.—USNM 195944, 10 specimens, 49.8 to 63.0 mm. in standard length; SU 55573, 2 specimens, 50.5 and 60 mm. in standard length; BM 1961.3.24.1–2, 2 specimens, 54 and 63.5 mm. in standard

length; UH 2584, 2 specimens, 51 and 60.5 mm. in standard length. All paratypes with same collecting data as holotype.

Description (data in parentheses are the extremes in counts and measurements for paratypes when differing from holotype).—Dorsal rays X,12; anal rays III,6 (2 paratypes with 5); pectoral rays i,7,vi (i,7,vi or ii,6,vi, usually the former); lateral-line scales 45 (44 to 47; see table 3); 3 rows of large scales above lateral line in middle of body; scales below lateral line to origin of anal fin 10 (9 or 10); gill rakers 4+1+10 (3 to 5+1+9 to 11, modally 4+1+10) (17 specimens).

Each of the following measurements is given as a percentage of the standard length. Measurements of paratypes are based on 4 USNM specimens, 49.8, 55.7, 62.0 and 63.0 mm. in standard length. Greatest depth of body 35.9 (34.5 to 35.7); width of body at gill opening 14.4 (13.6 to 15.7); head length 32.3 (32.3 to 34.3); snout length 9.6 (9.0 to 10.6); eye diameter 8.8 (8.4 to 9.0); postorbital length of head 14.3 (14.4 to 15.2); bony interorbital space 4.6 (4.3 to 4.7); least depth of caudal peduncle 12.4 (11.6 to 12.7); length of caudal peduncle 14.5 (14.3 to 14.9); snout to origin of dorsal fin 30.9 (29.5 to 31.7); snout to origin of anal fin 65.2 (63.2 to 65.4); snout to origin of pelvic fin 41.0 (40.3 to 43.5); length of dorsal fin base 59.0 (58.1 to 59.7); length of anal fin base 17.7 (16.2 to 17.5); length of pectoral fin 34.2 (34.4 to 37.7); length of pelvic fin 23.1 (21.6 to 22.9); length of pelvic spine 16.8 (14.4 to 16.7); length of first dorsal spine 7.7 (6.5 to 7.8); length of longest (the fourth or fifth) dorsal spine 18.7 (17.5 to 18.5); length of tenth dorsal spine 13.9 (13.5 to 14.3); length of first dorsal soft ray 24.0 (21.1 to 24.2); length of last dorsal ray 12.0 (11.4 to 12.4); length of first anal spine 10.3 (9.9 to 11.7); length of second anal spine 21.8 (20.5 to 22.6); length of third anal spine 16.6 (14.4 to 17.7); length of first anal soft ray 22.4 (18.0 to 21.0); length of last anal ray 15.3 (13.5 to 15.6); length of caudal fin 24.8 (24.4 to 26.9).

In addition to those of the family and genus, the following characters apply to this species: profile of head, excluding eye, with a marked indentation above eye; maxillary nearly reaching a vertical at front edge of eye; interorbital space markedly concave, scaled only anteriorly, the scaled region extending to space between anterior nostrils; preorbital not scaled, its hind margin free for about half the distance from lower edge to eye and rarely bearing a few serrations (only 2 of 17 specimens showed distinct serrations on the lower hind edge of the preorbital); margin of preopercle smoothly curved, all but anterior most part with from 11 to 19 (more on larger specimens) coarse, spinelike serrations (18 on holotype on one side and 19 on the other); suprascapula with 4 to 7 coarse serrations (6 on holotype); 4 rows of

large scales on cheek, the third row overlapping the fourth, making it narrower than preceding rows; no small scales basally on cheek scales or at margins of this scaled region except anteriorly near hind edge of preorbital; 8 or 9 large scales on opercle with a few small scales anteriorly and posteriorly; interopercle scaled; free fold of gill membranes across isthmus scaled; about 6 median predorsal scales; 8 rows of scales above lateral line on caudal peduncle on one side to lateral line on other; small scales basally on fins; first dorsal soft ray slightly prolonged; membranes of spinous portion of dorsal fin moderately incised, the one between fifth and sixth dorsal spines indented about four-tenths the length of the spines; pelvic fins reach beyond anus, almost to origin of anal fin; pectoral fins reach a vertical from base of second anal spine to second anal soft ray; second of lower unbranched pectoral rays usually the longest, extending beyond longest branched ray for a distance equal to about half the length of the branched ray; first anal soft ray unbranched; caudal fin emarginate, the caudal indentation about one-third to two-fifths eye diameter; a fringe of about 6 cirri on flap at rear of anterior nostril; cirri near tips of dorsal spines relatively thin and short.

Color in alcohol light tan with 2 broad vertical dark brown bars, one running downward from occipital region of head and anterior part of dorsal fin to upper part of opercle and the other centered at base of sixth to seventh dorsal spines and running to lateral line, these bars formed by dark edges on scales which appear as lengthwise zigzag lines (bars very faint on some specimens); a third faint dusky region on back may be seen on some specimens centered at origin of soft portion of dorsal fin, and 2 still fainter regions more posteriorly, the last dorsally on caudal peduncle; dorsal fin whitish basally, hyaline distally, the clear part of soft portion of fin with faint dusky rings about the size of the pupil; anal fin dusky, especially anteriorly in soft portion, except outer part of membranes in spinous portion which are hyaline; caudal fin hyaline with dusky spots arranged in a large median posterior crescent, those in lower part of fin darker than those in upper part; paired fins pale.

The following color note was made by L. P. Schultz on May 16, 1950, when the specimens reached the U.S. National Museum: "Upon arrival this cirrhitid was barred with bright reddish orange; mouth orange; a red bar from behind eye down across cheek, another from front of eye across preorbital, corner of mouth, meeting its fellow on underside of head; tip of chin red; red streak along middorsal line of snout to tip of snout; gill membranes over isthmus red; red spots with black margins on dorsal fin; caudal fin posteriorly with black spots; vertical red bars (on head and body) made up of red blotches which are more or less arranged in lengthwise rows."

REMARKS.—Named *serratus* both in reference to the zigzag lines that form the dark bars on the body and the coarse serrations on the preopercle.

A problem exists with respect to the type locality. Although the fish were collected in Pearl Harbor, Oahu, they were taken from around a drydock that was hauled to the Hawaiian Islands a year before from Guam, Mariana Islands. It is possible that this species came from Guam with the drydock. Three adult specimens of *Cirrhitichthys oxycephalus* that were taken at the same time as the series of *serratus* constitutes evidence in favor of an initial Mariana Islands locality, for the wide-ranging and relatively common *oxycephalus* is unknown from other collections from Hawaii.[3]

Cirrhitichthys falco, new species

FIGURE 28

HOLOTYPE.—AMNH 20412, a female specimen, 41.8 mm. in standard length, Gulf of Davao, Mindanao, Philippine Islands, Van Name Philippine Expedition, 1937.

PARATYPES.—AMNH 20413, 25.2 mm. in standard length; USNM 195954, 32.2 mm. in standard length. Paratypes with same collecting data as holotype.

DESCRIPTION (data in parentheses are the extremes in counts and measurements for paratypes when differing from holotype).—Dorsal rays X,12; anal rays III,6; pectoral rays i,7,vi (smallest paratype with upper 2 pectoral rays unbranched); lateral-line scales 42 (42 to 45); 3 rows of large scales above lateral line in middle of body; scales below lateral line to origin of anal fin 9; gill rakers 4+1+9 (3+1+9 or 10).

Each of the following measurements is given as a percentage of the standard length. Greatest depth of body 34.0 (29.3 to 32.3); width of body at gill opening 14.4 (12.7 to 14.9); head length 35.9 (35.3 to 35.7); snout length 11.2 (10.6 to 10.7); eye diameter 9.8 (10.0 to 10.2); postorbital length of head 16.0 (15.1 to 16.7); bony interorbital space 4.5 (4.4 to 4.6); least depth of caudal peduncle 12.0 (12.1 to 12.7); length of caudal peduncle 14.1 (14.7 to 15.1); snout to origin of dorsal fin 36.3 (33.8 to 35.7); snout to origin of anal fin 65.9 (62.7 to 64.7); snout to origin of pelvic fin 45.0 (42.2 to 46.2); length of dorsal fin base 55.5 (51.2 to 56.0); length of anal fin base 14.3 (14.6 to 15.8); length of pectoral fin 39.0 (30.5 to 37.6); length of pelvic fin 22.2 (21.8 to 23.3); length of pelvic spine 15.6 (15.2 to 15.4); length of first dorsal spine 8.8 (7.8 to 8.0); length of

[3] After the above was written, additional specimens of *serratus* were collected by W. A. Starck, II, D. P. de Sylva and others of the Marine Laboratory, University of Miami, in September and October 1961 at Gorgona Island, Colombia, and La Plata Island, Ecuador, within the depth range 5 to 35 feet.

longest (fourth) dorsal spine 19.1 (16.3 to 20.8); length of tenth dorsal spine 13.4 (13.5 to 14.3); length of first dorsal soft ray 22.5 (18.7 to 20.8); length of last dorsal ray 11.7 (10.9 to 11.9); length of first anal spine 10.5 (10.3 to 10.5); length of second anal spine 23.2 (22.0, broken in smallest paratype); length of third anal spine 16.4 (15.1) to 16.5); length of first anal soft ray 21.3 (18.3 to 21.7); length of last anal ray 12.2 (12.6 to 13.1); length of caudal fin 23.1 (24.9 to 25.8).

In addition to the characters of the family and genus, the following apply to this species: profile of head, excluding eye, without a marked indentation above eye; hind edge of maxillary slightly forward of a vertical at front edge of eye; interorbital space markedly concave, scaled only anteriorly, the scaled region extending slightly anterior to anterior nostrils; preorbital not scaled, its hind margin free for almost one-half the distance from lower edge to eye and bearing no serrations; preopercular margin smoothly rounded, the upper three-fifths with 11 (6 or 8) coarse serrations; suprascapula with 3 or 4 serrations (only one developed on small paratype); 4 rows of large scales on cheek, the third row overlapping the fourth, making it narrower than preceding rows; no small scales basally on cheek scales or at margins of this scaled region except anteriorly near hind edge of preorbital; 9 large scales on opercle with a few small scales anteriorly and posteriorly; interorbital scaled; free fold of gill membranes across isthmus scaled; about 7 median predorsal scales; 8 rows of scales above lateral line on caudal peduncle on one side to lateral line on other; small scales basally on fins; first dorsal soft ray not prolonged into a filament; membranes of spinous portion of dorsal fin moderately incised, the one between fifth and sixth dorsal spines indented about three-eighths length of the spines; pelvic fins reach beyond anus, almost to origin of anal fin; pectoral fins reach a vertical from base of third anal spine to first anal soft ray; second of lower unbranched rays the longest, extending beyond longest branched ray a distance contained 1.6 times in length of the branched ray; first anal soft ray unbranched; caudal fin emarginate; a fringe of about 4 cirri on hind margin of anterior nostril (only one cirrus seen on paratypes); cirri near tips of dorsal spines relatively long and thick.

Color in alcohol light brown with 5 vertical dark brown bars on body (it may equally be stated that the basic pattern consists of 3 lengthwise rows of dark blotches), the first 2 comprised of small dark brown spots (which appear superimposed on dark blotches) and the last 3 of large brown blotches; first bar, which is centered on origin of dorsal fin and passes on to opercle, decidedly darker than remaining bars; a pair of brown spots, one above and one below lateral line, between dark bars; a dark brown line running ventrally

from eye to throat and another running diagonally forward and downward from eye across maxillary and mandible to chin; a median dorsal dark band running from interorbital to upper lip; a few dark brown spots on occiput; a dark streak at base of pectoral; 3 dark spots in a vertical line at extreme base of caudal fin, the uppermost located middorsally; caudal fin crossed with 3 vertical rows of spots with slightly paler centers; dorsal fin hyaline with a few dark spots, mostly representing continuation of body bars into base of fin; anal fin hyaline with a faint brownish band from base of third spine to distal ends of first few soft rays; paired fins pale. Life color not known.

Remarks.—This species is very closely related to *serratus*. It differs in the straighter profile of the head the fewer lateral-line scales (see table 3), the larger dorsal cirri, and in color principally in the more obvious posterior bars of dark blotches and intermediate spots and the occurrence of discrete spots to form the dark anterior bars rather than dark edges of the scales as in *serratus*. Some of these differences, such as the lack of indentation in the dorsal profile of the head of *falco* and the color pattern, may be due to the difference in the size of the specimens. The largest specimen of *falco*, the holotype, is 41.8 mm. in standard length and the smallest *serratus*, 51 mm. The holotype of *falco*, however, is definitely not a juvenile. It is a ripe female with ova up to 0.3 mm. in diameter.

Table 3.—*Lateral-line scales of* Cirrhitichthys serratus *and* C. falco

	42	43	44	45	46	47
C. serratus	–	–	6	8	1	2
C. falco [1]	2	2	1	1	–	–

[1] Both sides counted.

Cirrhitichthys oxycephalus (Bleeker)

Figure 29

Cirrhites oxycephalus Bleeker, 1855, Natuurk. Tijdschr. Nederlandsch-Indië, vol. 8, p. 408 (type locality, Amboina, East Indies).

Cirrhitichthys oxycephalus Bleeker, 1876–77, Atlas ichthyologique . . . , vol. 8, pp. 146, 147, pl. 353, fig. 1 (East Indies).

Cirrhites grandimaculatus Liénard, *in* Sauvage, 1891, Poissons, vol. 16 of Histoire physique, naturelle et politique de Madagascar, p. 211 (type locality, Mauritius).

Cirrhites murrayi Regan, 1909, Proc. Zool. Soc. London, p. 404, pl. 66, fig. 6 (type locality, Christmas Island, Indian Ocean).

Cirrhitichthys corallicola Tee-Van 1940, Zoologica, vol. 25, p. 58, text fig. 2 (type locality, Gorgona Island, Pacific coast of Colombia).

Cirrhitichthys aprinus de Beaufort, 1940 (in part; non Cuvier), The fishes of the Indo-Australian Archipelago, vol. 8, p. 9, fig. 3.

DIAGNOSIS.—Dorsal rays X,12 (one with 13); anal rays III,6; pectoral rays i,7,vi (one with ii,6,vi); lateral-line scales 41 to 45 (usually 43 or 44); 3 rows of large scales above lateral line in middle of body; 10 scales below lateral line to origin of anal fin; gill rakers 3 to 5+1+9 to 11 (usually 4+1+10) (20 specimens, Red Sea, Phoenix Islands, Marquesas Islands, and Gorgona Island, Colombia).

Depth of body 2.8 to 3 in standard length; snout 3.5 to 3.7 in head length; fifth dorsal spine the longest, its length 1.7 to 2.2 in depth; bony interorbital space about 2 in eye of adults; median anterior part of interorbital and region between nostrils scaled; profile of head, excluding eye, without a marked indentation above eye; serrations on preopercle 14 to 19 (at standard lengths greater than about 45 mm., see fig. 1); preorbital unscaled or with a few scales, its free hind edge without spines; maxillary ends slightly posterior to a vertical at front of eye (except Red Sea specimens; on these the maxillary extending almost to center of eye); first dorsal soft ray prolonged, at least in sizes greater than about 35 mm. standard length; tips of pelvic fins extending beyond anus (except Red Sea specimens); caudal fin slightly emarginate to truncate.

Color in alcohol light tan with 4 lengthwise rows of subquadrate dark brown spots on body; in addition, a row of smaller spots on lateral line interspersed between larger spots; a series of spots as large as the last-mentioned one at base of dorsal fin; opercle and interopercle with a line of about 5 blackish spots; dark brown spots on nape, snout, and ventrally on head, those at latter location arranged in 2 bands running ventrally from eye; dorsal and caudal fins spotted with dark brown; remaining fins pale.

Life color of 70 mm. specimen from the Marquesas: light brown on back shading almost to white ventrally, with prominent dark brown to red blotches (those on caudal peduncle and above anal fin red) on head and in 4 lengthwise rows on body (in addition, 4 smaller spots in a row along lateral line between upper 2 rows); dorsal fin light brown, spotted with dark brown on spinous portion and basal soft portion of fin and with red on outer part of soft portion; cirri near tips of dorsal spines red; filamentous first dorsal soft ray yellow; caudal fin with dusky membranes and reddish rays, and spotted with red and dark brown (some spots red with dark brown centers), except distal half of upper 3 principal caudal rays which are yellowish; anal and pelvic fins reddish; pectoral fin membranes hyaline, rays dusky basally, red distally; mouth slightly reddish; iris orange with a ring of brown.

REMARKS.—The holotype (No. 5844), 61 mm. in standard length, is in the Rijksmuseum van Natuurlijke Historie at Leiden.

This cirrhitid has the greatest known range of the family, occurring throughout the tropical Indo-Pacific and eastern Pacific. There are specimens in the U.S. National Museum from the Red Sea (collected by D. S. Erdman); Christmas Island (Indian Ocean), East Indies, Philippines, Fiji, Solomon Islands (collected by W. M. Chapman); Gilbert Islands and Marquesas (collected by the author); Marshall Islands (collected by D. W. Strasburg); Phoenix Islands; Gorgona Island and Port Utria (Colombia), Panama, Costa Rica, and Cocos Island (collected by W. L. Schmitt); and Clipperton Island (collected by W. J. Baldwin).

A hawkfish from Christmas Island, Line Islands (B. P. Bishop Museum 4129) which was identified as *Paracirrhites cinctus* by Fowler (1927, p. 18) was sent to the author by E. H. Bryan, Jr. Although in poor condition, it could be identified as *C. oxycephalus*.

A 33-mm. specimen of *oxycephalus* from Madras, India, sent on loan by A. C. Wheeler of the British Museum (No. 1889.2.1.3033) bears the name *Cirrhitichthys stictos* Day. No publication could be found which lists *stictos*, and it is probably only a manuscript name.

The 3 Red Sea specimens that were examined appear differentiated from the species elsewhere in its range by having a maxillary which extends almost to a vertical at the center of the eye, shorter dorsal spines, and shorter pectoral fins (extending only slightly posterior to a vertical at end of pelvic fins). Two of the specimens have pelvic fins which do not reach the anus.

Largest specimen examined, 70 mm. in standard length. This specimen was collected with a spear in 8 feet of water from a small head of *Pocillopora* in Anaho Bay, Nuku Hiva, Marquesas Islands.

Cirrhitichthys aureus (Temminck and Schlegel)

FIGURE 30

Cirrhites aureus Temminck and Schlegel, 1843, Pisces, *in* Siebold, Fauna Japonica . . ., p. 15, pl. 7, fig. 2 (type locality, Nagasaki, Japan).

Cirrhites gibbosus Guichenot, 1869, Nouv. Arch. Mus. Hist. Nat., Paris, vol. 5, p. 199, pl. 12, fig. 2 (type locality, Macao, China).

Cirrhitichthys aureus Jordan and Herre, 1907, Proc. U.S. Nat. Mus., vol. 33, p. 161, fig. 1 (southern Japan and China).

Cirrhitichthys aureus Fowler, 1931, Hong Kong Nat., vol. 2, p. 306 (Hong Kong).

DIAGNOSIS.—Dorsal rays X,12; anal rays III,6; pectoral rays i,7,vi or i,6,vii; lateral-line scales 40 to 44; 3 rows of large scales above lateral line in middle of body; 10 scales below lateral line to origin of anal fin; gill rakers 4 to 6+1+9 (7 specimens, Japan and China).

Depth of body 2.2 to 2.5 in standard length; snout 3.4 to 3.6 in head length; longest dorsal spine 2.2 to 2.6 in depth; bony interorbital space about 1.6 in eye of adults; median anterior part of interorbital space and region between nostrils scaled; profile of head, excluding

eye, with a marked indentation above eye; preorbital unscaled, its free hind edge with or without 1 to 4 small spines; maxillary ends beneath front edge of eye; first dorsal soft ray prolonged; tips of pelvic fins reach beyond anus; caudal fin slightly emarginate.

Color in alcohol of 3 specimens from Japan (USNM 57752–53), 81 to 87 mm. standard length, uniform light yellowish brown, the fins pale yellowish. The life color is golden yellow. Two specimens in the Academy of Natural Sciences of Philadelphia from Hong Kong (ANSP 76759), 92 and 93 mm. in standard length, show about 5 faint bars on the body with short bars between centered on the lateral line and a spot on the opercle behind the eye. Fowler recorded the life color of these as golden yellow brown with brown edges to the scales, yellowish pink caudal peduncle, and red caudal fin.

Remarks.—The types of *aureus* are in the Rijksmuseum van Natuurlijke Historie at Leiden. Boeseman (1947, p. 33) designated No. 536 as lectotype. The type of *Cirrhites gibbosus* Guichenot from Macao (MNHN 3060) is the largest specimen of *aureus* seen; it measures 117 mm. in standard length and 138 mm. in total length. Guichenot described his type as yellow, with brownish yellow back and yellowish fins.

The 4⅓-in. specimen reported from Misaki, Japan, by Jordan and Herre was believed to have been taken from "rather deep water."

Cirrhitichthys calliurus Regan

Figure 31

Cirrhitichthys calliurus Regan, 1905, Journ. Bombay Nat. Hist. Soc., vol. 16, p. 322, pl. B, 3 (type locality, Muscat, Gulf of Oman).

Diagnosis.—Dorsal rays X,12; anal rays III,6; pectoral rays i,6,vii or ii,5,vii; lateral-line scales 42; 3 rows of large scales above lateral line in middle of body; 10 scales below lateral line to origin of anal fin; gill rakers 3 or 4+1+9 or 10 (2 specimens, Red Sea).

Depth of body 2.4 in standard length; snout 3.6 in head length; longest dorsal spine 2.3 in depth; bony interorbital space 1.6 in eye; median anterior part of interorbital space and region between nostrils not scaled; profile of head, excluding eye, with a marked indentation above eye; preorbital unscaled, the free hind margin without spines; maxillary ends slightly posterior to vertical at front edge of eye; first dorsal soft ray prolonged; tips of pelvic fins reaching slightly beyond anus; caudal fin slightly emarginate, almost truncate.

Color in alcohol brown (the centers of the scales are a little paler than the edges, hence the body has a slight linear pattern); caudal fin abruptly pale yellowish with a broad blackish posterior border and about 18 small blackish spots; dorsal and anal fins brown like body; paired fins pale; lips pale. Regan stated that the fish is brown-

ish, darkly marbled (his figure shows dark bars), the soft dorsal and anal fins and caudal peduncle almost blackish, and the caudal fin pale yellowish with a pink tinge at the base, dark posterior margin and dark spots.

Remarks.—Two specimens (MNHN 95.174–5), 57 mm. in standard length, collected by M. Jousseaume at Obock, Red Sea, were examined in Paris. Otherwise known only from the 2 original specimens, 64.5 and 84 mm. in standard length, taken at 15 to 30 fathoms off Muscat, Gulf of Oman. These are cataloged in the British Museum under No. 1904.5.25.

C. calliurus is closely related to *bleekeri* and *aureus* (see "Remarks" under *bleekeri*).

Cirrhitichthys bleekeri Day

Figure 32

Cirrhitichthys bleekeri Day, 1873, Proc. Zool. Soc. London, p. 705 (type locality, Madras, India).

Cirrhitichthys aureus Day, 1875, (non Temminck and Schlegel), The fishes of India . . ., p. 145, pl. 35, fig. 5, (Madras, India).

Diagnosis.—Dorsal rays X,12 or 13; anal rays III,6 or 7; lower 6 or 7 pectoral rays unbranched; lateral-line scales 43 (given as 45 or 46 in original description); 3 rows of large scales above lateral line in middle of body (4 to origin of dorsal fin); 12 scales below lateral line to origin of anal fin.

Depth of body about 2.4 in standard length; profile of head, excluding eye, with a marked indentation above eye; preorbital without scales; no mention of spines on hind margin of preorbital; maxillary reaches to below first third of eye; first dorsal soft ray prolonged; pelvic fins do not reach anus; caudal fin slightly emarginate.

Color rosy with light longitudinal lines and a large ill-defined blotch below the soft portion of the dorsal fin extending half way down the side; in some specimens 2 more descend from spinous portion of dorsal fin; a small dark spot behind upper edge of preopercle; dorsal and caudal fins more or less banded, the caudal with red spots; soft portion of dorsal darker than spinous portion and having a light outer edge.

Remarks.—Day's original description (1873) differs from his account of the species in his "Fishes of India" (1875–78, pp. 145–146) which, in turn, does not correspond in all respects with the plate (reproduced herein as fig. 32). Notable among the differences are the lateral-line scale counts (given as 45 or 46 in original description and as 43 in "Fishes of India"), size of the eye, and length of the snout and of the longest dorsal spines. These differences are impossible to resolve without seeing specimens.

No type or other specimens were located in those museums visited or at others through correspondence (see p. 391).

C. bleekeri is evidently very closely related to *aureus* and *calliurus*. Day, in fact, ultimately placed his *bleekeri* in the synonymy of *aureus*. However, the pelvic fins falling short of the anus, noted by Day, and the different color pattern seem to differentiate *bleekeri*. It is not inconceivable that *aureus*, *bleekeri*, and *calliurus* may be demonstrated eventually as subspecies of one species in continuous distribution from Japan and China to the Red Sea.

Day stated that *bleekeri* is rather common at Madras and that it attains a length of about 4 inches.

Cirrhitichthys guichenoti (Sauvage)

FIGURE 33

Cirrhites guichenoti Sauvage, 1880, Bull. Soc. Philomath. Paris, p. 221 (type locality, Réunion); 1891, Histoire Naturelle des Poissons *in* Grandidier, Histoire physique, naturelle et politique de Madagascar, vol. 16, p. 212, pl. 23, fig. 1 (Réunion).

DIAGNOSIS.—Dorsal rays X,13; anal rays III,7; pectoral rays i,7,vi; lateral-line scales 53; 4 rows of large scales above lateral line in middle of body; gill rakers 5+1+11 (1 specimen).

Depth of body about 3.1 in standard length; snout 2.95 in head length; longest dorsal spine about 1.8 in depth; bony interorbital space about 2 in eye; median anterior part of interorbital space and region between nostrils scaled; profile of head, excluding eye, with a marked indentation above eye; preorbital with a few small scales posteriorly, the free hind margin without spines; maxillary ends before eye; relative length of first dorsal soft ray unknown (this ray broken on specimen); caudal fin truncate.

Color in alcohol brown with 3 lengthwise rows of large dark brown spots; middle row of spots, which follows lateral line, with a small spot between successive large spots; a small black spot behind eye at upper end of free margin of preopercle; a dark streak from eye almost to angle of preopercle, a second running from eye to maxillary, and a third running anteriorly on snout from eye; median fins spotted with brown; cirri at tips of dorsal spines pale.

REMARKS.—The holotype (MNHN 4091) measures 112 mm. in standard length and 166 mm. in total length. Other measurements are: depth of body 35.5 mm.; width of body at gill opening 9.3 mm.; head length 38.1 mm.; snout length 12.9 mm.; snout to end of maxillary 11.5 mm.; diameter of eye 12.1 mm.; bony interorbital space 6 mm.; first dorsal spine 9 mm.; fifth dorsal spine the longest, 20 mm.; ninth and tenth dorsal spines subequal, 16 mm.; length of pectoral fins 38 mm., the tips of elongate lower rays reaching slightly posterior

to a vertical at ends of pelvic fins; length of pelvic fins 24 mm. There are 20 coarse serrations on the free margin of the preopercle.

The illustration of *guichenoti* in Sauvage (1891) is in error in failing to show the branched pectoral rays abruptly shorter than the lower unbranched rays. The lowest branched ray on the specimen is about two-thirds the length of the adjacent unbranched ray. The caudal fin is not rounded, but nearly truncate, and the first dorsal spine is slightly less than half the length of the fifth dorsal spine instead of three-fifths the length, as shown in the figure.

This species is remarkably similar in color pattern to *Cirrhitichthys oxycephalus* but is easily distinguished from this and other members of the genus by its longer snout and higher scale and fin-ray counts. Judging from the length of the one known specimen from Réunion (166 mm.), it is the largest species in the genus.

Genus *Cyprinocirrhites* Tanaka

Cyprinocirrhites Tanaka, 1917, Dobuts. Zasshi (Zool. Mag., Tokyo), vol. 29, no. 347, p. 269. (Type species, *Cyprinocirrhites ui* Tanaka=*Cirrhitichthys polyactis* Bleeker.)

Diagnosis.—Generic characters are given in the key to the genera and the diagnosis of *polyactis*, which appears to be the only species in the genus.

Cyprinocirrhites seems to be closely related to *Cirrhitichthys*. Smith's (1951) belief that further study of *Cyprinocirrhites* might warrant its elevation to family rank seems unlikely.

Cyprinocirrhites polyactis (Bleeker)

Figure 34

Cirrhitichthys polyactis Bleeker, 1875, Verh. Akad. Wetensch., Amsterdam, vol. 15 (1874), p. 16 (type locality, Amboina, East Indies); 1876–77, Atlas ichthyologique . . ., vol. 8, p. 147, pl. 76, fig. 1.

Cyprinocirrhites ui Tanaka, 1917, Dobuts. Zasshi (Zool. Mag., Tokyo), vol. 29, no. 347, p. 269 (type locality, Tanabe, Japan).

Cyprinocirrhites stigma Fowler, 1943, U.S. Nat. Mus. Bull. 100, vol. 14, pt. 2, p. 65, fig. 11 (type locality, Labuan Blanda Island, Buton Strait, East Indies).

Diagnosis.—Dorsal rays X,16 or 17 (one with 17); anal rays III,6; pectoral rays i,7,vi; lateral-line scales 47 to 49; 3 rows of large scales above lateral line in middle of body; 9 scales below lateral line to origin of anal fin; gillrakers 4+1+11 or 12 (one with 12) (6 specimens, Philippines).

Palatine teeth present; free margin of preopercle almost entirely serrate, the upper margin with 12 to 16 coarse serrations; preorbital with hind margin free for about one-fourth the distance from lower edge to eye; interorbital and dorsal part of snout scaled; 4 rows of

large scales on cheek (the lower row partially covered by third row); depth of body about 2.7 to 2.8 in standard length; snout short, not pointed, its length about 4 to 5 in head length; mouth highly oblique; lower jaw projecting anterior to upper; maxillary short, ending slightly posterior to front edge of eye; a tuft of cirri from membrane near tip of each dorsal spine; membranes of dorsal fin not deeply incised, the one between fifth and sixth dorsal spines notched less than one-fourth length of spines; third dorsal spine the longest, its length about 2.3 to 2.5 in depth of body; first dorsal soft ray produced into a filament; pectoral fins long, the longest rays reaching to a vertical at base of first or second anal soft rays; longest unbranched pectoral ray nearly twice as long as longest branched ray; tips of pelvic fins reaching or nearly reaching origin of anal fin; caudal fin lunate, the lobes extending as filaments, the caudal indentation about 1.3 to 1.5 in head length.

Color in alcohol uniform light yellowish brown, the fins pale yellowish except outer third of spinous portion of dorsal fin which is dusky. Life color probably orange-yellow.

Remarks.—Two syntypes of *polyactis*, 84 and 92 mm. in standard length, are in the Rijksmuseum van Natuurlijke Historie at Leiden (No. 5845). M. Boeseman wrote that the larger example is in better condition than the smaller. The larger one is here designated as the lectotype.

C. polyactis is known from the 2 type specimens from Amboina, one specimen from Timor (Weber, 1913, p. 259), one from Japan (Tanaka, 1917), one from Queensland, Australia (McCulloch, 1922, p. 243), one from the Philippines (Fowler, 1943, p. 65, fig. 11), and one from Madagascar (Smith, 1951, p. 647, fig. 3). In addition, the U.S. National Museum has 6 from the Philippines.

The holotype of *Cyprinocirrhites stigma* Fowler (USNM 99505), a 42-mm. specimen, was examined. It has a dorsal fin formula of X,16 (not XI,17 as given by Fowler) and possesses palatine teeth. The dark markings on the body ascribed to the specimen by Fowler are merely regions where scales are missing. Fowler distinguished his species from *C. ui* Tanaka on the basis of several characters, most of which do not appear valid. The larger size of the eye and the longer dorsal spines of *stigma* (the latter difference not mentioned by Fowler) may be due to the difference in size of the specimens under comparison. The holotype of *ui* is about 50 mm. longer than the single specimen of *stigma*.

The largest of all the known specimens is the one from Madagascar which is 112 mm. in fork length (about 96 mm. standard length). The species appears to live at moderate depths. The Madagascar specimen, for example, was taken at 60 fathoms. The type of *C. stigma* was collected from 24 fathoms.

The deeply forked caudal fin, somewhat elongate body, and small oblique mouth of *Cyprinocirrhites* suggest plankton-feeding habits and a more open-water mode of life than that of other cirrhitids. To confirm this suspicion, the stomachs of 4 Philippine specimens, 50 to 70 mm. in standard length (one of which, a 66 mm. specimen, is a ripe female), were opened. The contents proved to be zooplankton: copepods, larval shrimp, larval crabs, fish eggs, and soft material that appears to be pelagic tunicate. Several families of tropical marine fishes have representatives that depart from a bottom-dwelling existence typical of the group to live in a semipelagic habitat. All have more lunate caudal fins, more fusiform body shape, and smaller mouths, generally, than their benthic relatives. Examples are *Paranthias* of the Serranidae, *Caesio* and *Ocyurus* of the Lutjanidae, *Clepticus* of the Labridae, and certain species of *Chromis* of the Pomacentridae. These fishes do not strain the organisms from the sea, but pick the individual plankters one by one. When danger approaches, they retire to the reef for shelter. *Cyprinocirrhites* may behave in the same way.

Genus Oxycirrhites Bleeker

Oxycirrhites Bleeker, 1857, Act. Soc. Sci. Indo-Neérlandicae, vol. 2, p. 39. (Type species, *Oxycirrhites typus* Bleeker, by monotypy.)

Fowler (1934, p. 358) created a new subfamily, Oxycirrhitinae, for the genus *Oxycirrhites*. De Beaufort (1940, pp. 13–15), on the other hand, included the species *Amblycirrhitus bimacula* in the genus. *Oxycirrhites* is here regarded as a monotypic genus of the subfamily Cirrhitinae. Generic characters are given in the discussion of *typus*.

Oxycirrhites typus Bleeker

FIGURE 35

Oxycirrhites typus Bleeker, 1857, Act. Soc. Sci. Indo-Neérlandicae, vol. 2, p. 40 (type locality, Amboina, East Indies); 1876–77, Atlas ichthyologique . . ., vol. 8, pp. 141, 148, pl. 351, fig. 2.

Oxycirrhites typus de Beaufort, 1940, The fishes of the Indo-Australian Archipelago, vol. 8, pp. 14, 15, fig. 4.

Oxycirrhites morrisi Fowler, 1934, Proc. Acad. Nat. Sci. Philadelphia, vol. 85, p. 359 fig. 109 (type locality, eastern Palawan, Philippine Islands).

Oxycirrhites seftoni Böhlke and Briggs, 1935, California Fish and Game, vol. 39, p. 375, figs. 1, 2 (type locality, off Palmilla Point, San José del Cabo Bay, Baja California).

DIAGNOSIS.—Dorsal rays X,13; anal rays III,7; pectoral rays ii,7,v or ii,6,vi; lateral-line scales 51 to 53; 4 rows of large scales above lateral line in middle of body; 10 scales below lateral line to origin of anal fin; gill rakers 5+1+11 or 12 (4 specimens, Philippines, Sumatra and Baja California).

Canine teeth in jaws small, not markedly longer than inner villiform teeth, and nearly uniform in size; palatine teeth absent; free margin of preopercle serrate, the serrations on upper limb coarse; curved hind margin of preorbital free for about one-fourth the distance from lower edge to eye; interorbital not scaled; 3 rows of large scales on cheek with a few forming an incipient fourth row; depth of body 4.4 to 4.6 in standard length (Böhlke and Briggs, 1953, p. 375, reported the depth of *seftoni* as 4.2; however their figure shows a depth of about 4.4 in standard length); snout very elongate, its length about 2 in head length; dorsal profile of head slightly concave; 2 to 4 cirri from membrane near tip of each dorsal spine (1 or none from last 2 spines); membranes between dorsal spines deeply incised, the one between the fifth and sixth spines notched nearly half the length of these spines; fourth dorsal spine the longest, its length 1.28 to 1.46 in body depth; first dorsal soft ray not produced into a filament; pectoral fin length variable, the tips of longest rays not reaching pelvic tips in Indo-Malayan form but extending to or beyond origin of anal fin in eastern Pacific form; longest branched pectoral ray contained 1.2 to 1.35 in length of longest unbranched pectoral ray; tips of pelvic fins reach slightly posterior to anus; caudal fin emarginate.

Color in alcohol pale, some specimens retaining 9 bars which slant diagonally posteriorly as they pass downward on the body, and 4 lengthwise dark bands, resulting in a cross-hatching effect on the body. The dark markings are red in life and the ground color whitish. Two lengthwise dark bands in dorsal fin.

Remarks.—Known in the literature from 4 specimens: the type from Amboina, a specimen from Mauritius (Günther, 1860, p. 76), the type of *morrisi* from the Philippines, and the type of *seftoni* from Baja California. The holotype of *typus* is in the Rijksmuseum van Natuurlijke Historie at Leiden (No. 5846). M. Boeseman kindly supplied the following information on the specimen: standard length 84 mm., total length 100 mm., depth of body 19 mm., head length 36 mm., snout length 18.9 mm., postorbital part of head 11.2 mm., diameter of eye 6 mm., length of longest unbranched pectoral ray 18 mm., length of longest branched pectoral ray 15 mm., length of third dorsal spine 12.2 mm., length of fourth dorsal spine 13 mm., length of tenth dorsal spine 10.1 mm., length of second anal spine 13.7 mm., length of pelvic spine 9 mm., caudal indentation 4.5 mm., indentation of membrane between fifth and sixth dorsal spines 5.4 mm., number of serrations on preopercular margin 23 (20); number of pectoral rays (both sides) ii,7,v.

The type of *O. morrisi* Fowler (USNM) measures 72 mm. in standard length, and it is uniformly pale (probably faded). In his description of

morrisi, Fowler made errors (he reported lateral-line scales as 47 instead of 51; dorsal spines as IX instead of X; pectoral rays as iii,6,v instead of ii,7,v; third dorsal spine as 2¼ in head instead of 2.7; second anal spine as 2.5 in head instead of 2.7) which led Böhlke and Briggs into erroneous conclusions on most of the differences they attributed to *morrisi* and their *seftoni*.

Böhlke and Briggs distinguished *seftoni* from *typus* by the different placement and size of the bars on the body, the longer second lower unbranched pectoral ray, the shorter tenth dorsal spine (relative to the third), the shorter second anal spine, the shorter pelvic spine, larger eye, and more numerous preopercular serrations.

De Beaufort (1940, p. 16) reported and Boeseman confirmed that the type of *typus* is discolored; thus the comparison in size and placement of bars between *typus* and *seftoni* must depend on the figure of Bleeker (reproduced as fig. 3 by Böhlke and Briggs). Unless an error was made by the artist, the bars are narrower and begin more posteriorly on *typus*. More impressive than these possible differences is the similarity in pattern. Both *typus* and *seftoni* have 9 vertical oblique bars and 4 lengthwise bands (5 in figure of *typus*, but Bleeker's description gives 4). Both have 2 lengthwise dark bands in the dorsal fin.

Table 4 presents the counts and proportional measurements that Böhlke and Briggs have utilized to distinguish *seftoni* from *typus* and *morrisi*. Included also are data from a specimen (No. 1929.6.12.2) from Sumatra sent on loan from the British Museum and two specimens from Baja California collected in 1959 and 1961 off Cape San Lucas by R. Rosenblatt and associates of the Scripps Institution of Oceanography and loaned to the author.

The differences of Böhlke and Briggs appear to be resolved in the more accurate data from specimens not seen by them and from specimens collected since their paper was written. The short second anal spine of the type of *seftoni* is probably an abnormality. This spine appears blunt in the figure of the species. The two additional specimens from Baja California have a more normally pointed spine which is consistent in length with that of *typus* and *morrisi*. Instead of 1, these specimens have the upper 2 pectoral rays unbranched, and the Sumatra specimen has the lower 6 pectoral rays branched like *seftoni*; the i,7,vi count of *seftoni* is therefore no longer distinctive.

Two specimens of *Oxycirrhites* have recently been collected in Hawaii. These may be reported upon by R. and D. Morris.

Oxycirrhites is evidently a moderately deepwater form. The type of *morrisi* was dredged from 51 fathoms, the Sumatra specimen from 53 fathoms, and the type of *seftoni* from 25 fathoms. The second

specimen from Baja California was collected with rotenone at a depth of 110 to 120 feet. The third one was taken at 65 feet.[4]

TABLE 4.—*Comparison in certain counts and measurements of specimens of* Oxycirrhites

	Type of *typus* (84 mm.) [1]	Type of *morrisi* (72 mm.)	Sumatra specimen (85.5 mm.)	Type of *seftoni* (73 mm.) [2]	2d Baja Calif. specimen (53 mm.)	3d Baja Calif. specimen (78.5 mm.)
Length of longest pectoral ray in head	2.0	2.1	1.8	1.7	1.6	1.8
Length of longest branched pectoral ray in longest unbranched ray	1.2	1.23	1.30	1.35	1.34	1.28
Length of tenth dorsal spine in third dorsal spine	1.2	1.2	1.25	1.4	1.3	1.3
Length of third dorsal spine in head	3.0	2.7	2.6	2.6	2.7	2.8
Length of second anal spine in head	2.6	2.7	2.5	3.0	2.6	2.7
Length of pelvic spine in head	4.0	4.0	3.3	4.1	3.6	3.7
Diameter of eye in head	6.1	6.4	6.1	6.3	5.5	6.0
Snout length in head	1.9	2.0	2.0	2.0	2.0	2.0
Pectoral rays	ii,7,v	ii,7,v	ii,6,vi	i,7,vi	ii,6,vi	ii,6,vi
Lateral-line scales	52	51	53	51	52	53
Preopercular serrations	23	13	20	22	11	20

[1] M. Boeseman, Rijksmuseum van Natuurlijke Historie, written communication.
[2] Böhlke and Briggs (1953).

Literature Cited

DE BEAUFORT, L. F.
1940. The fishes of the Indo-Australian Archipelago. Vol. 8, xv+508 pp., 56 figs. E. J. Brill, Leiden.

BLEEKER, P.
1875. Sur les espèces insulindiennes de la famille des Cirrhitéoïdes. Verh. Akad. Wetensch., Amsterdam, vol. 15 (1874), pp. 1–20.
1876–77. Atlas ichthyologique des Indes Orientales Néerlandaises . . . Vol. 8, 156 pp., 36 col. pls. Fréderic Muller et Cie., Amsterdam.

BOESEMAN, M.
1947. Revision of the fishes collected by Burger and von Siebold in Japan. Zoöl. Meded., Leiden, vol. 28, viii+242 pp., 5 pls.

BÖHLKE, J., and BRIGGS, JOHN C.
1953. The rare cirrhitid fish genus *Oxycirrhites* in American waters. California Fish Game, Sacramento, vol. 39, no. 3, pp. 375–380, 3 figs.

BREDER, C. M., JR.
1927. Scientific results of the first oceanographic expedition of the *Pawnee*, 1925. Bull. Bingham Oceanogr. Coll., vol. 1, no. 1, pp. 1–90, 36 figs.

[4] After the above was written, three specimens were collected in Piñas Bay, Panama, in 60 feet of water by Walter A. Starck II and others of the Marine Laboratory, University of Miami. A fourth specimen was speared by Starck at a depth of 35 feet at Gorgona Island, Colombia. This fish was observed in life to be concealed in, but not touching, a gorgonian. A 35-mm. kodachrome transparency taken by Starck shows 4 horizontal and 9 near-vertical maroon bars on a whitish ground color.

Chacko, P. I.
1949. Food and feeding habits of the fishes of the Gulf of Manaar. Proc. Indian Acad. Sci., no. 29B, pp. 83–97.

Day, Francis
1875–78. The fishes of India . . . xx+778 pp., 198 pls. B. Quaritch, London.

Fourmanoir, P.
1954. Ichthyologie et pêche aux Comores. Mem. Inst. Sci. Madagascar, ser. A, vol. 9, pp. 187–239, 2 maps, 19 figs.

Fowler, Henry W.
1925. Fishes of Guam, Hawaii, Samoa, and Tahiti. Bull. B. P. Bishop Mus. 22, 38 pp.
1927. Fishes of the tropical central Pacific. Bull. B. P. Bishop Mus. 38, pp. 1–32, 1 pl., 6 text figs.
1931. The fishes of Oceania—Supplement 1. Mem. B. P. Bishop Mus., vol. 11, no. 5, pp. 312–381, 7 figs.
1934. Descriptions of new fishes obtained 1907 to 1910, chiefly in the Philippine Islands and adjacent seas. Proc. Acad. Nat. Sci. Philadelphia, vol. 85, pp. 233–367, 117 figs.
1938. Descriptions of new fishes obtained by the United States Bureau of Fisheries steamer *Albatross*, chiefly in Philippine seas and adjacent waters. Proc. U.S. Nat. Mus., vol. 85, pp. 31–135, 56 figs.
1943. Contributions to the biology of the Philippine Archipelago and adjacent regions. Descriptions and figures of new fishes . . . U.S. Nat. Mus. Bull. 100, vol. 14, pt. 2, pp. 53–91, 22 figs.
1959. Fishes of Fiji. 670 pp., 246 figs. Government of Fiji, Suva.

Gosline, William A., and Brock, Vernon E.
1960. Handbook of Hawaiian fishes. ix+372 pp., frontis., 277 figs. Univ. Hawaii Press, Honolulu.

Gregory, William K.
1933. Fish skulls: a study of the evolution of natural mechanisms. Trans. Amer. Philos. Soc., vol. 23, no. 2, vii+75–481, 302 figs.

Günther, Albert C. L. G.
1860. Catalogue of the acanthopterygian fishes in the collection of the British Museum. Vol. 2, xxi+548 pp. Taylor and Francis, London.
1874. Andrew Garrett's Fische der Südsee. Vol. 1 (Journ. Mus. Godeffroy, vol. 2), 128 pp., 83 pls.

Harry, Robert R.
1953. Ichthyological field data of Raroia Atoll, Tuamotu Archipelago. Atoll Res. Bull. 18, 190 pp., 7 figs. Pacific Science Board, National Research Council, Washington, D.C.

Herre, Albert W.
1953. Checklist of Philippine fishes. U.S. Fish Wildl. Serv. Res. Rep. 20, 977 pp.

Hiatt, Robert W., and Strasburg, Donald W.
1960. Ecological relationships of the fish fauna on coral reefs of the Marshall Islands. Ecol. Monogr., Durham, N.C., vol. 30, no. 1, pp. 65–127, 9 figs.

Jordan, David S., and Herre, Albert C.
1907. A review of the cirrhitoid fishes of Japan. Proc. U.S. Nat. Mus., vol. 33, pp. 157–167, 2 figs.

KAMOHARA, TOSHIJI
1954. Eleven additions to the fish fauna of Prov. Tosa, including one new species of the family Serranidae. Res. Rep. Kôchi Univ., vol. 3, no. 26, pp. 1–7, 3 figs.
1957. A list of fishes from Amami-Ōchima and adjacent regions, Kagoshima Perfecture, Japan. Rep. Usa Mar. Biol. Sta., vol. 4, no. 1, pp. 1–65, 38 figs.

KLUNZINGER, C. B.
1870. Synopsis der Fische des Rothen Meeres. I. Theil. Percoiden-Mugiloiden. Verh. Zool.-Bot. Ges. Wien, vol. 20, pp. 669–834.

MARSHALL, N. B.
1950. Fishes from the Cocos-Keeling Islands. Bull. Raffles Mus., Singapore, vol. 22, pp. 166–205, 3 figs.

MCCULLOCH, ALLAN R.
1922. Notes and illustrations of Queensland fishes, No. 3. Mem. Queensland Mus., vol. 7, no. 4, pp. 241–244.

RANDALL, JOHN E.
1955. Fishes of the Gilbert Islands. Atoll Res. Bull. 47, xi+243 pp., 2 figs. Pacific Science Board, National Research Council, Washington, D.C.

REGAN, C. TATE
1911. On the cirrhitiform percoids. Ann. Mag. Nat. Hist., ser. 8, vol. 7, pp. 259–262.

RÜPPELL, E.
1828. Atlas zu der Reise im nördlichen Afrika, Part 4. Fische des rothen Meeres. 141 pp., 35 col. pls. Heinr. Ludw. Brönner, Frankfurt.
1835. Neue Wirbelthiere zu der Fauna von Abyssinien gehörig. Fische des rothen Meeres. Vol. 1, pp. 81–148, pls. 22–23. Frankfurt.

SCHULTZ, LEONARD P.
1943. Fishes of the Phoenix and Samoan Islands collected in 1939 during the expedition of the U.S.S. *Bushnell*. U.S. Nat. Mus. Bull. 180, ix+316 pp., 9 pls., 27 text figs.
1950. Three new species of fishes of the genus *Cirrhitus* (Family Cirrhitidae) from the Indo-Pacific. Proc. U.S. Nat. Mus., vol. 100, pp. 547–552, 1 pl.

SCHULTZ, LEONARD P., and collaborators
1960. Fishes of the Marshall and Marianas Islands. U.S. Nat. Mus. Bull. 202, vol. 2, ix+438 pp., 49 pls., 42 text figs.

SMITH, J. L. B.
1951. The fishes of the family Cirrhitidae of the western Indian Ocean. Ann. Mag. Nat. Hist., ser. 12, vol. 4, pp. 625–652, 3 figs.
1955. The fishes of Aldabra, Part I. Ann. Mag. Nat. Hist., ser. 12, vol. 8, pp. 304–312, 1 pl.

STEINDACHNER, FRANZ, and DÖDERLEIN, L.
1884. Beiträge zur Kenntniss der Fische Japan's. II. Denkschr. Akad. Wissensch. Wien, vol. 48, pp. 1–40, 7 pls.

TEE-VAN, JOHN
1940. Eastern Pacific expeditions of the New York Zoological Society. XVII. A review of the American fishes of the family Cirrhitidae. Zoologica, vol. 25, no. 1, pp. 53–64, 1 pl., 4 text figs.

WATANABE, MASAO
1949. Studies on the fishes of the Ryukyu Islands. II. A new cirrhitoid fish. Bull. Biogeog. Soc. Japan, vol. 14, no. 2, pp. 17–20, 2 figs.
WEBER, MAX C. W.
1913. *Siboga*-Expeditie . . . Monogr. 57, Die Fische, xii+710 pp., 12 pls., 126 text figs. E. J. Brill, Leiden.

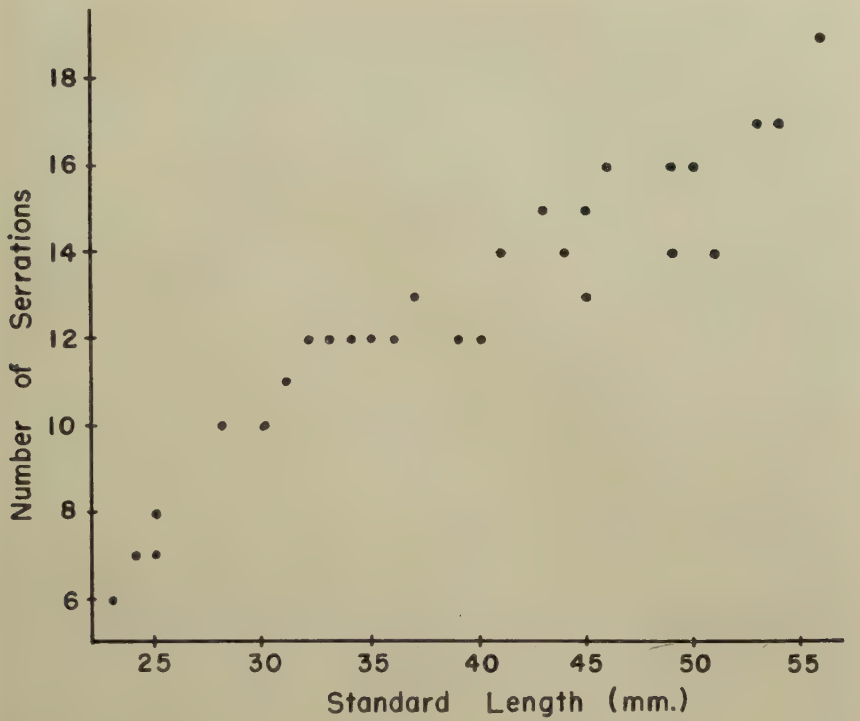


FIGURE 1.—Relationship of standard length and number of serrations on preopercle of *Cirrhitichthys oxycephalus*. Specimens from a collection from Gorgona Island, Pacific coast of Colombia.

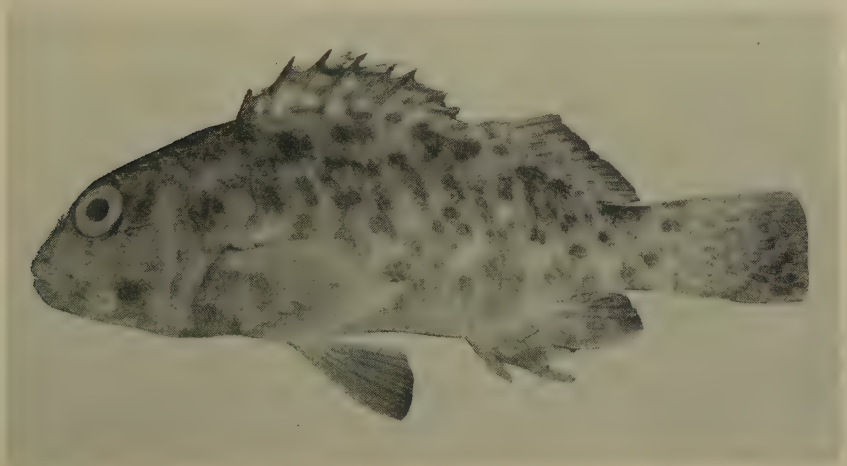
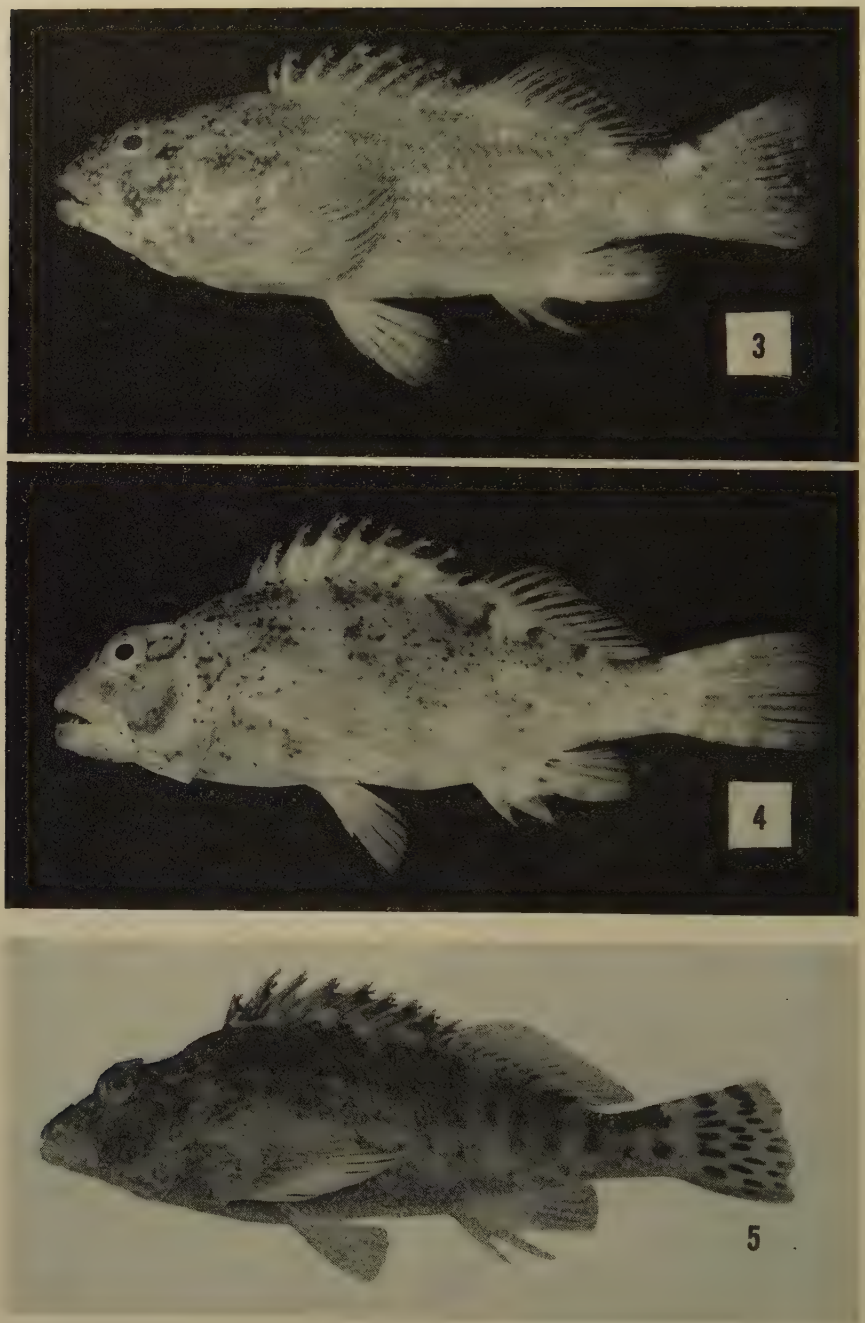
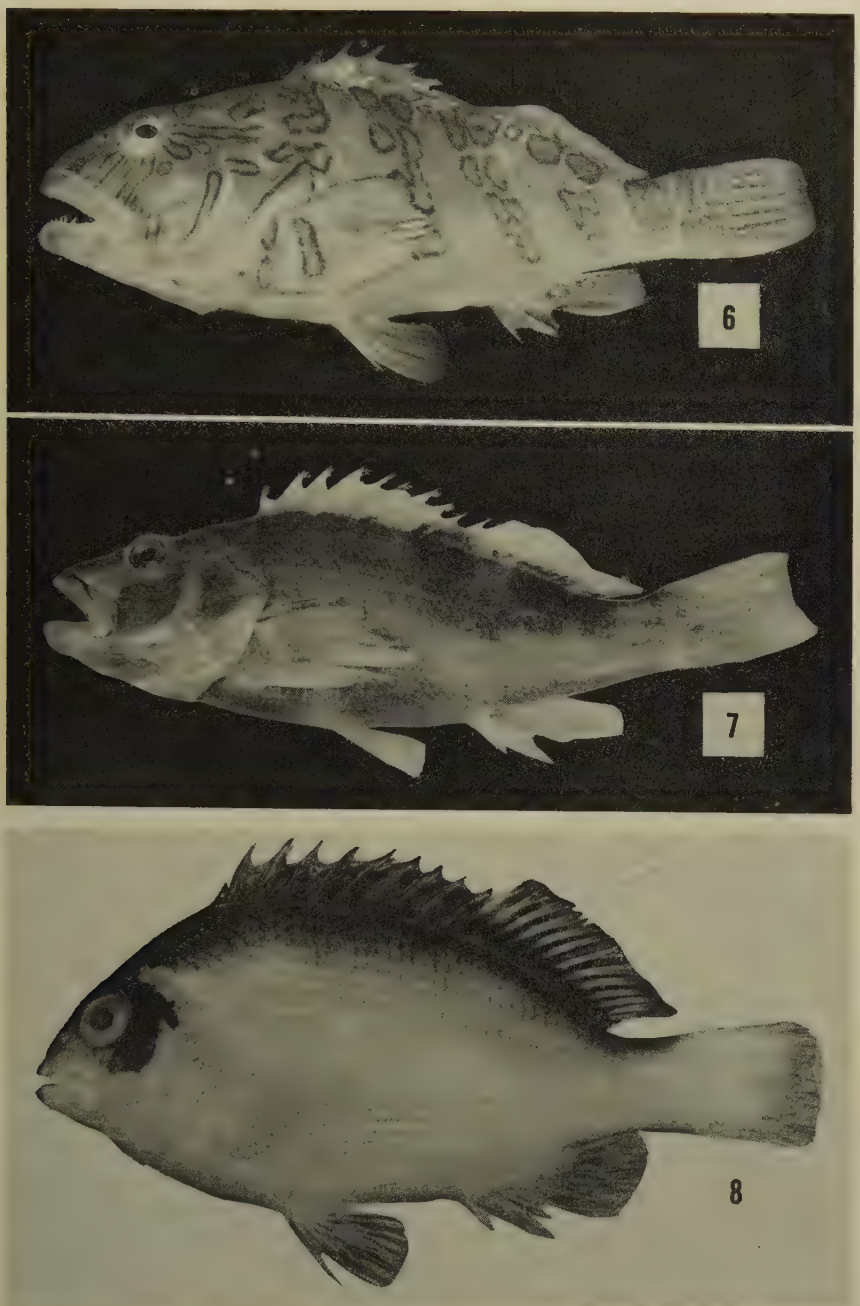


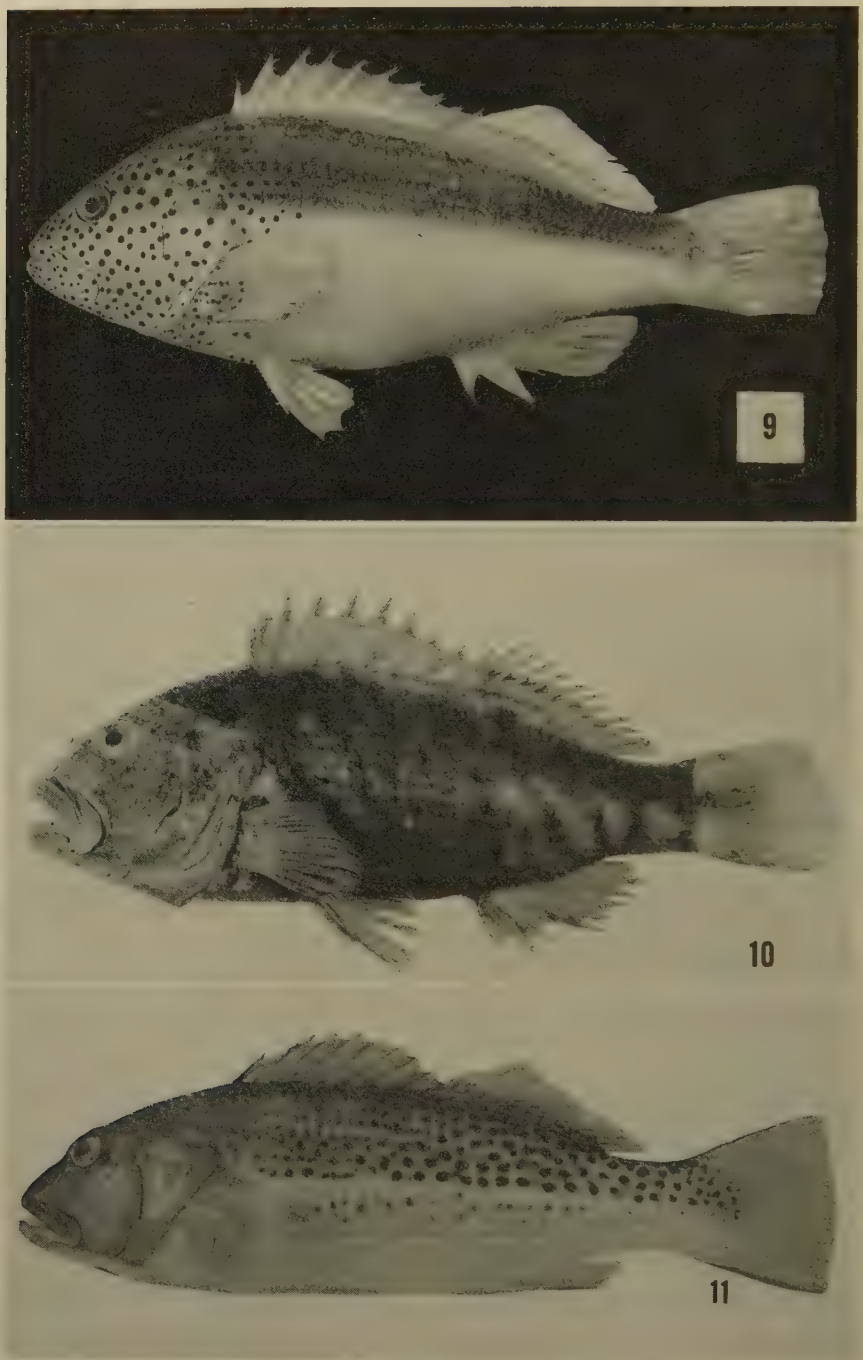
FIGURE 2.—*Cirrhitus pinnulatus* (Schneider), 87 mm. standard length, Tuamotu Archipelago USNM 164564.



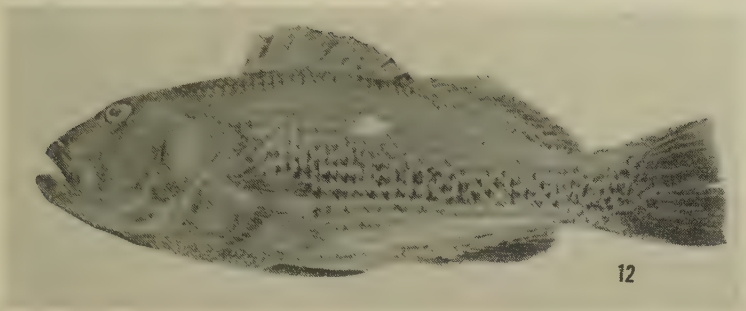
FIGURES 3–5.—Species of *Cirrhitus*. 3. *C. albopunctatus* Schultz, holotype, 100 mm. standard length, Niuafoo, USNM 91883. 4. *C. punctatus* Cuvier, 138 mm. standard length, holotype of *C. nigropunctatus* Schultz, Mauritius, USNM 13218. 5. *C. splendens* (Ogilby), 161 mm. standard length, Lord Howe Island; BM 1926.6.30.88.



FIGURES 6–8.—Species of *Cirrhitus* and *Neocirrhites*. 6. *C. rivulatus* Valenciennes, 175 mm. standard length, Secas Island, Panama, USNM 144464. 7. *C. atlanticus* Osorio, holotype, 155.5 mm. standard length, Ilheo das Rolas, west Africa, No. 510, Lisbon. 8. *N. armatus* Castelnau, 46 mm. standard length, Caroline Atoll, USNM 190581.



FIGURES 9–11.—Species of *Paracirrhites*. 9. *P. forsteri* (Schneider), 122 mm. standard length, Gilbert Islands, USNM 167407. 10. *P. typee*, new species, holotype, 157.5 mm. standard length, Nuku Hiva, Marquesas Islands, MNHN 2908, Paris. 11. *P. hemistictus* (Günther), 175 mm. standard length, Marshall Islands, USNM 166715. From a 35 mm. kodachrome transparency.



FIGURES 12–14.—Species of *Paracirrhites*. 12. *P. hemistictus* (Günther), *polystictus* phase 190 mm. standard length, Gilbert Islands, USNM 167404. From a 35 mm. kodachrome transparency. 13. *P. arcatus* (Cuvier), 89 mm. standard length, Tuamotu Archipelago, USNM 190585. 14. *P. amblycephalus* (Bleeker), Sangi Islands (after Bleeker, Atlas ichthyologique, pl. 350, fig. 1).

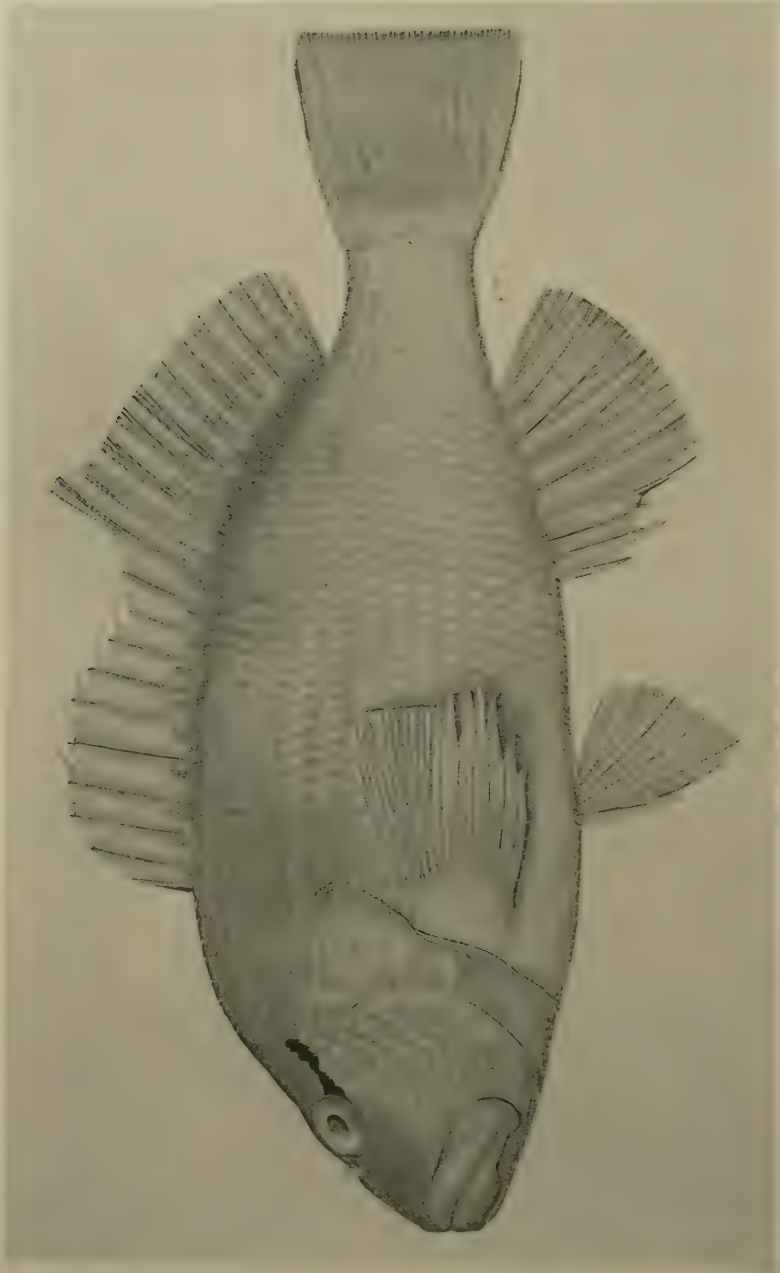


FIGURE 15. *Paracirrhites xanthus*, new species, holotype, 104 mm. standard length, Tuamotu Archipelago, USNM 190568.

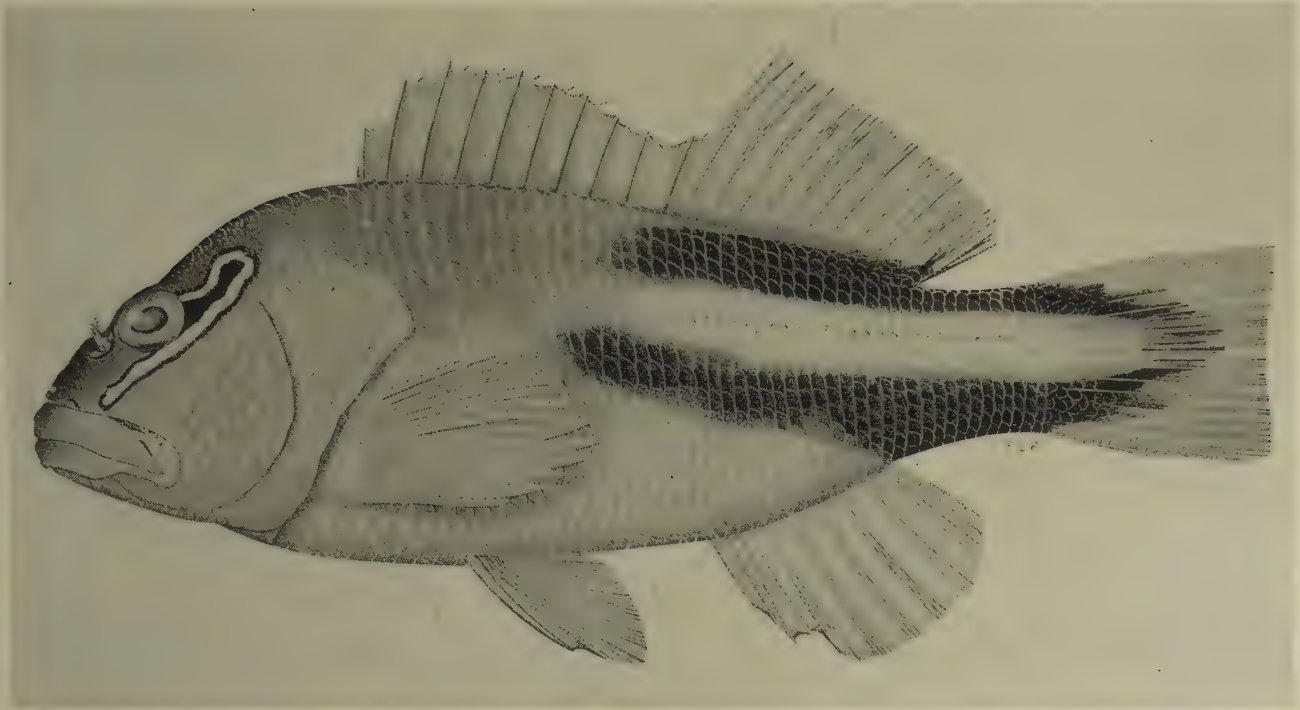


FIGURE 16.—*Paracirrhites nisus*, new species, holotype, 77 mm. standard length, Tuamotu Archipelago, USNM 190572.

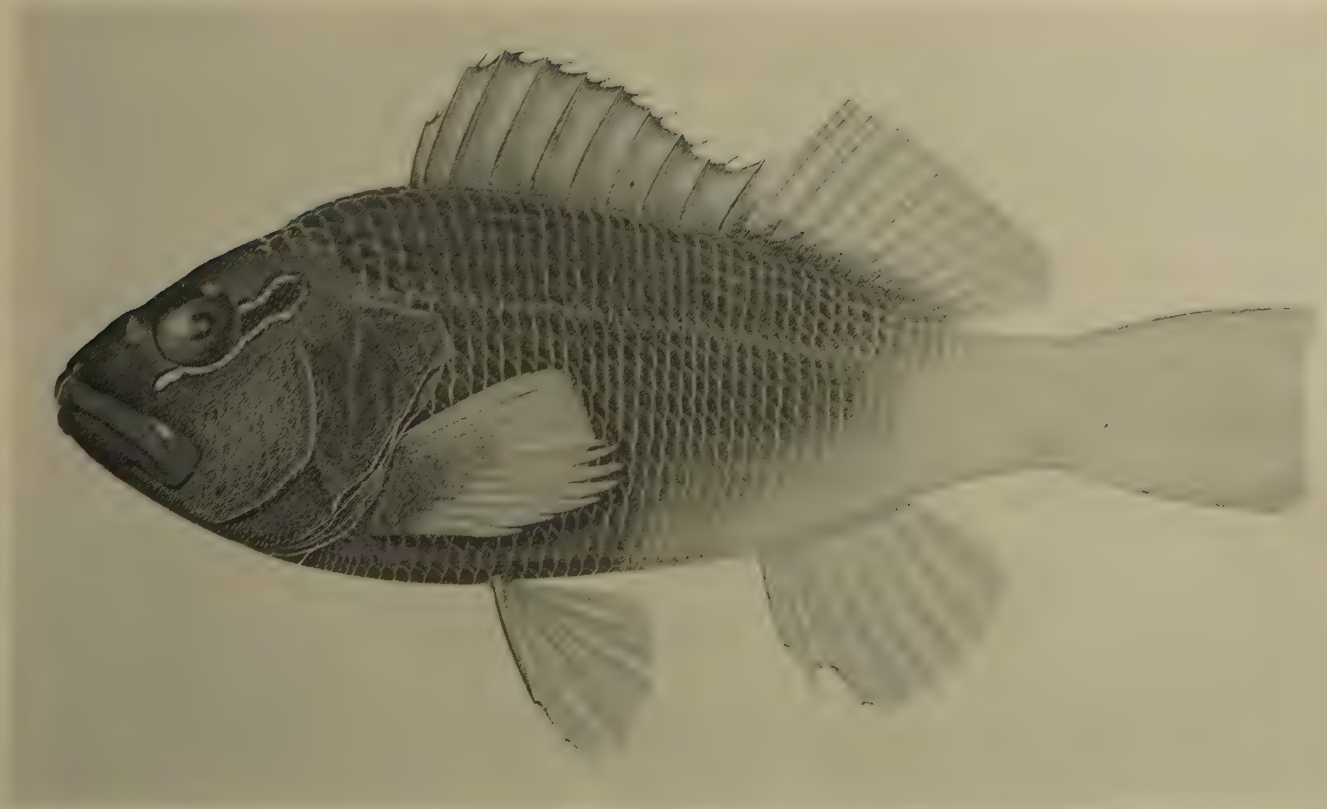
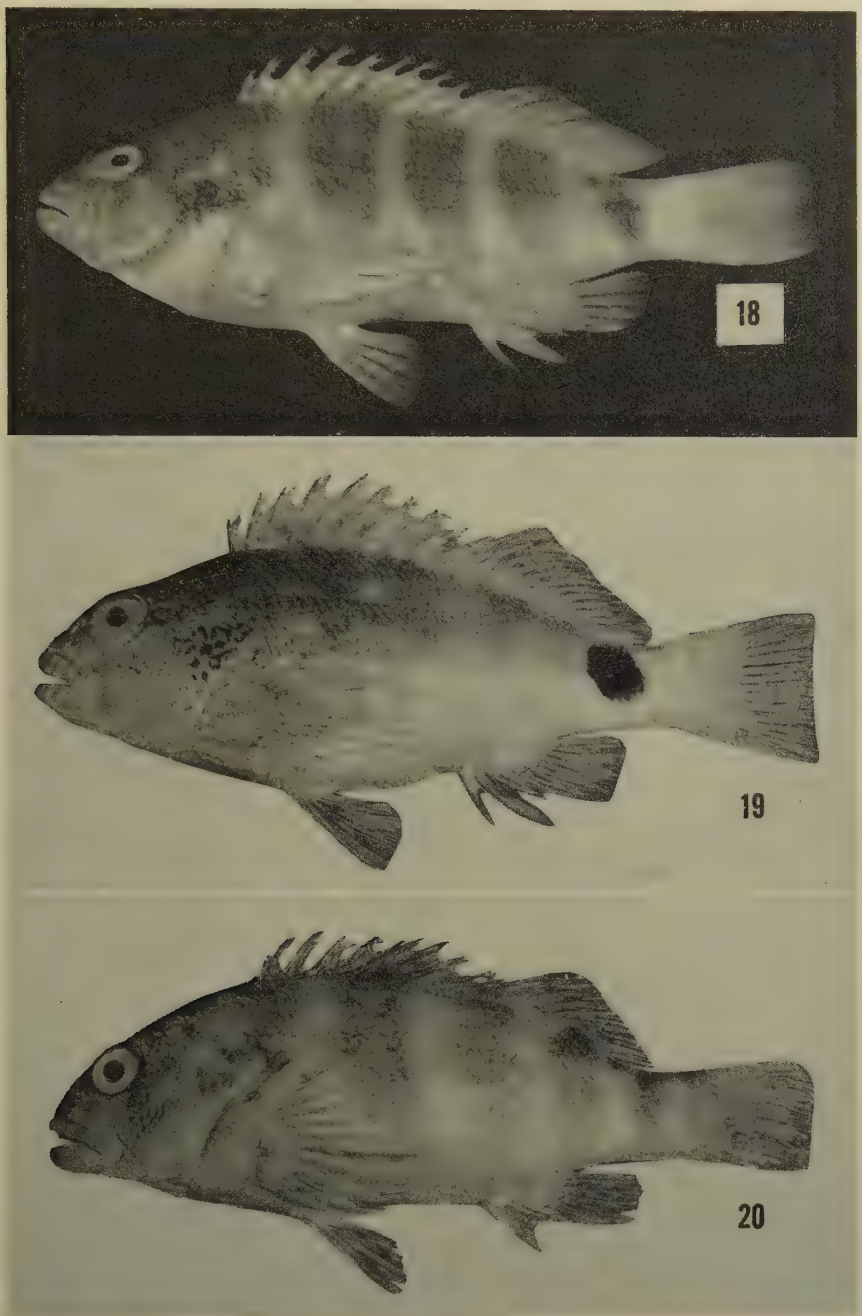
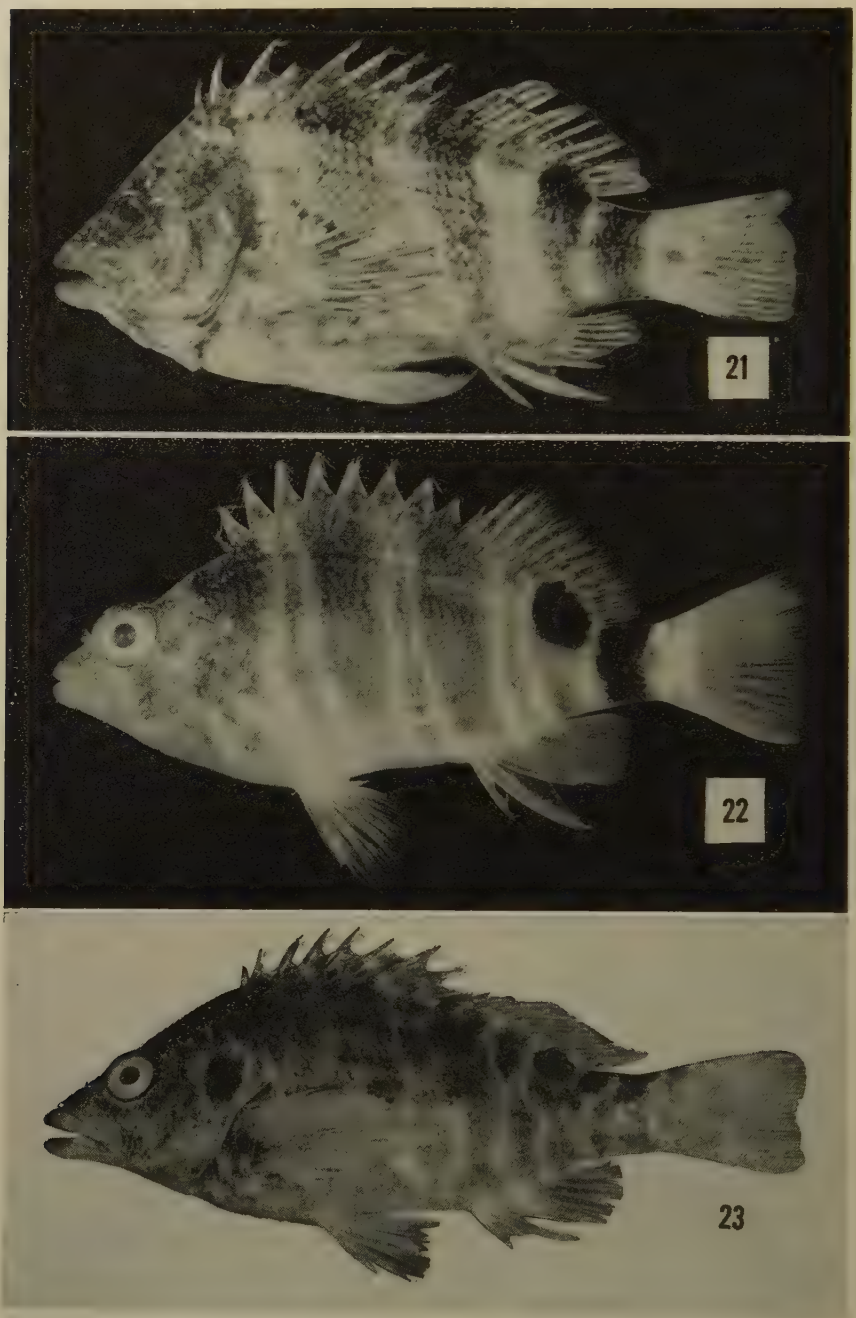


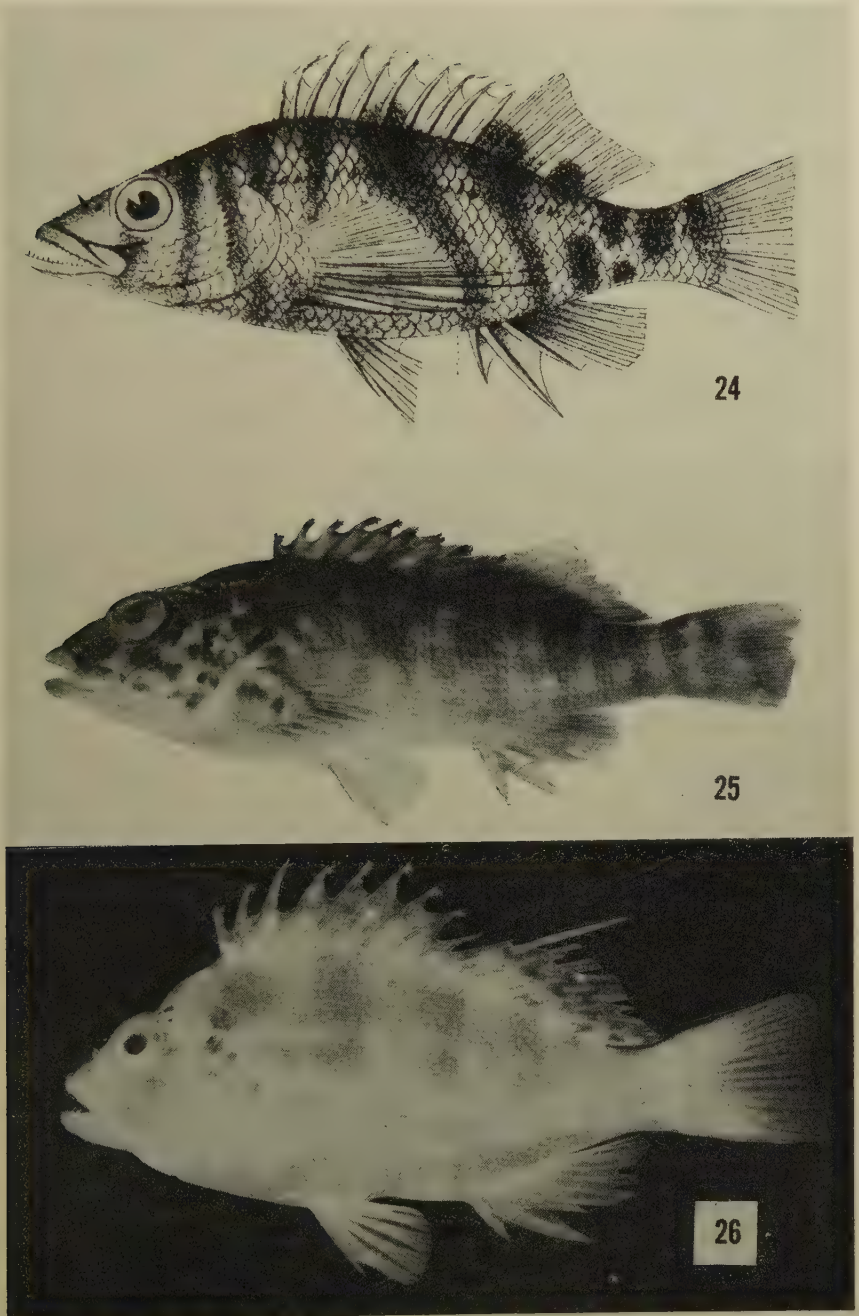
FIGURE 17.—*Paracirrhites bicolor*, new species, holotype, 73.5 mm. standard length, Caroline Atoll, USNM 190574.



FIGURES 18–20.—Species of *Cirrhitops* and *Isocirrhitus*. 18. *C. fasciatus* (Bennett), 92 mm. standard length, Hawaiian Islands, USNM 51041. 19. *C. hubbardi* (Schultz), 70 mm. standard length, Tuamotu Archipelago, USNM 190580. 20. *I. sexfasciatus* (Schultz), 62 mm. standard length, Tuamotu Archipelago, USNM 177694.



FIGURES 21–23.—Species of *Amblycirrhitus*. 21. *A. indicus* Fowler, holotype, 93 mm. standard length, India, MNHN 5428 A, Paris. A dried half-specimen mounted on glass. Both pelvic fins present. Fourth dorsal spine broken. 22. *A. pinos* (Mowbray), 54 mm. standard length, Virgin Islands, UMML 8438. 23. *A. bimacula* (Jenkins), 67 mm. standard length, Marshall Islands, USNM 141983.



FIGURES 24–26.—Species of *Amblycirrhitus* and *Cirrhitichthys*. 24. *A. oxyrhynchos* (Bleeker), Goram Islands (after Bleeker, Atlas ichthyologique, pl. 303, fig. 4). 25. *A. unimacula* (Kamohara), 63 mm. standard length, Lan Yu, Formosa, USNM 179312. 26. *C. aprinus* (Cuvier), 59 mm. standard length, Philippine Islands, USNM 150609.

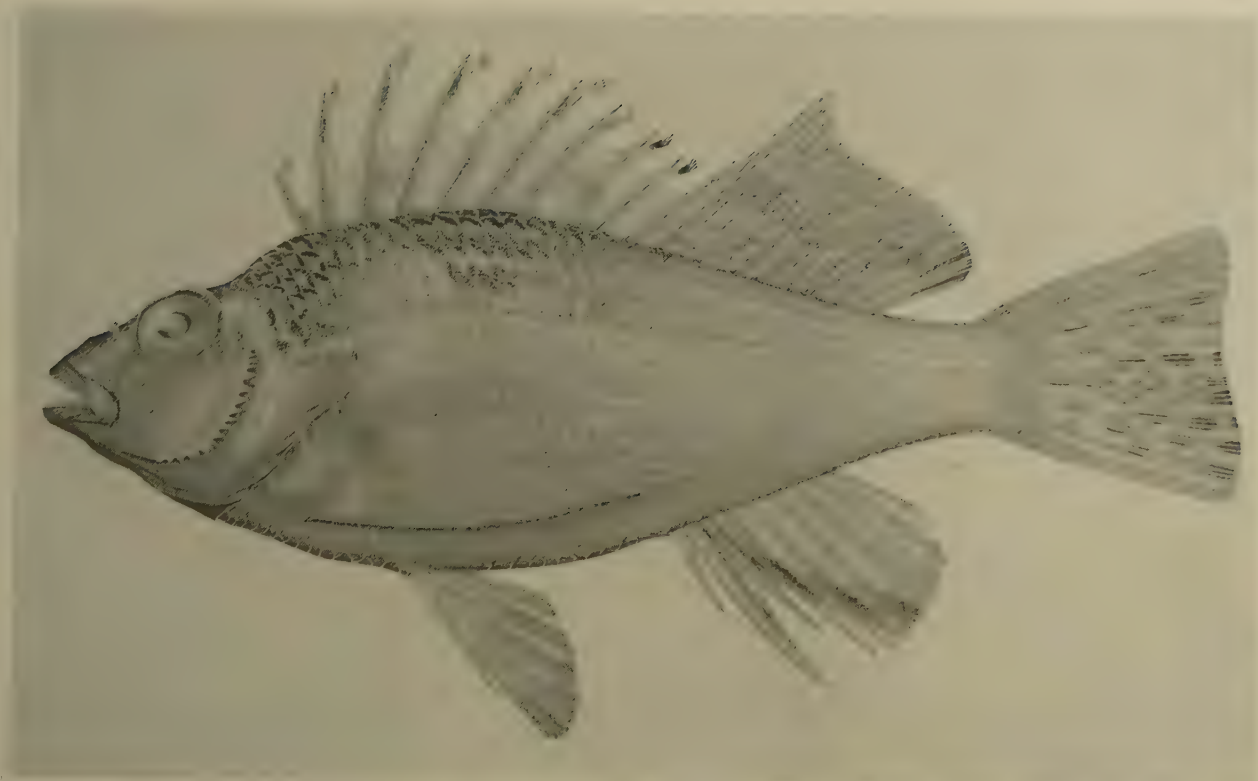
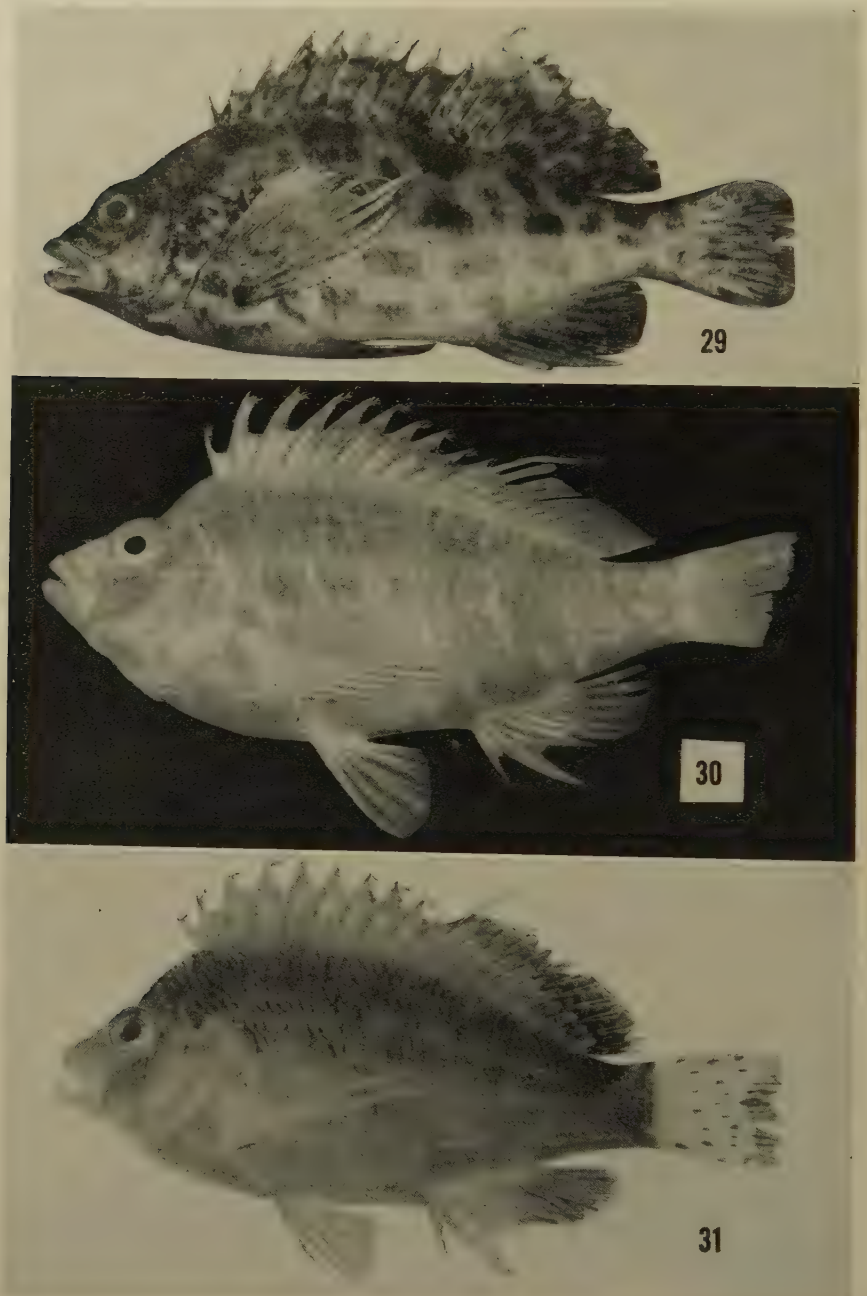
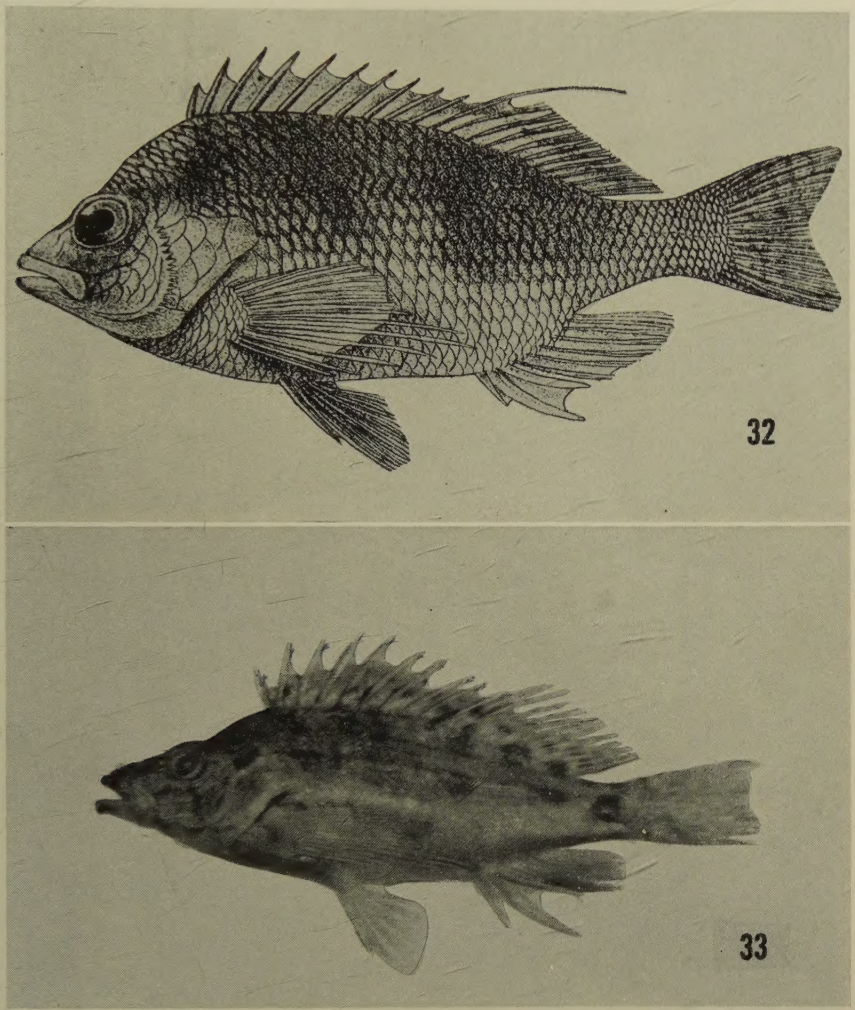


FIGURE 27. *Cirrhitichthys serratus*, new species, holotype, 62.7 mm. standard length, Hawaiian Islands (via drydock from Guam), USNM 195943.

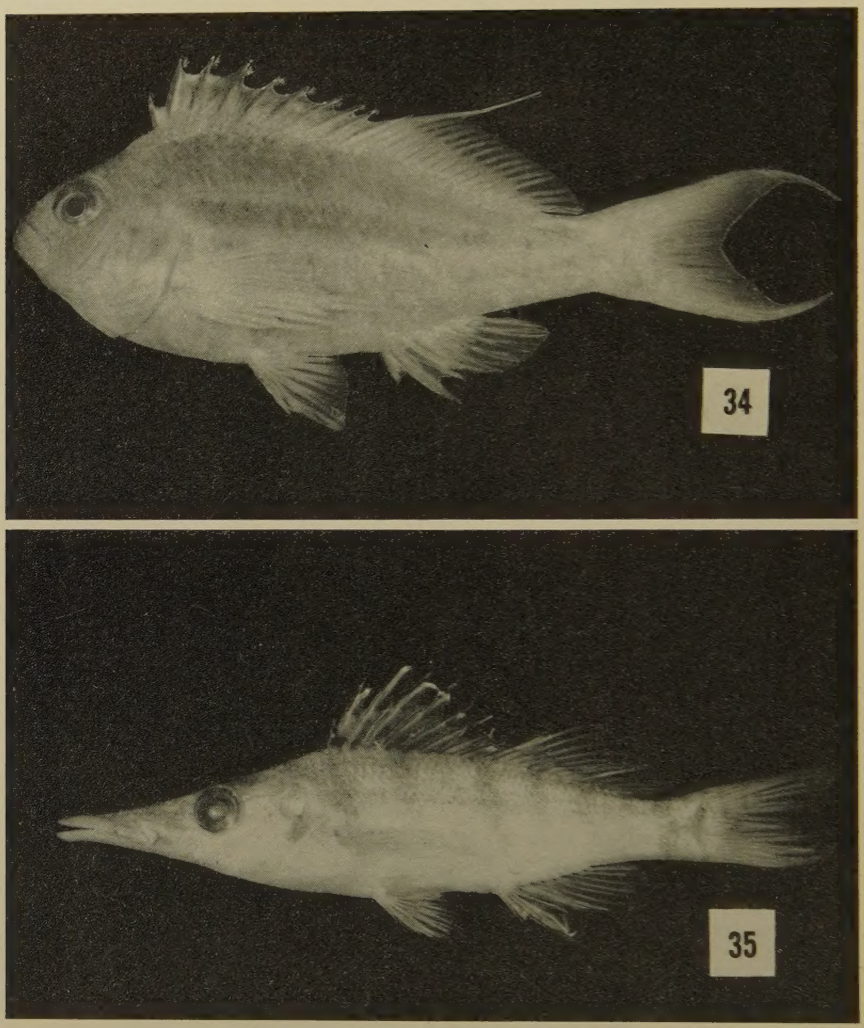
FIGURE 28.—*Cirrhitichthys falco*, new species, holotype, 41.8 mm. standard length, Mindanao, Philippine Islands, AMNH 20412.



FIGURES 29–31.—Species of *Cirrhitichthys*. 29. *C. oxycephalus* (Bleeker), 70 mm. standard length, Marquesas Islands, USNM 190576. 30. *C. aureus* (Temminck and Schlegel), 82 mm. standard length, Japan, USNM 57752. Caudal fin frayed. 31. *C. calliurus* Regan, 57 mm. standard length, Red Sea, MNHN 95174, Paris.



FIGURES 32, 33.—Species of *Cirrhitichthys*. 32. *C. bleekeri* Day, Madras, India (after Day, Fishes of India, pl. 35, fig. 5). *33. C. guichenoti* (Sauvage), holotype, 112 mm. standard length, Réunion, MNHN 4091, Paris.



FIGURES 34, 35.—Species of *Cyprinocirrhites* and *Oxycirrhites*. 34. *C. polyactis* (Bleeker), 73 mm. standard length, Philippine Islands, USNM 150615. 35. *O. typus* Bleeker, 53 mm. standard length, Baja California, SI059–215.

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